THE

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The "Tropical Agriculturist."

The *Tropical Agriculturist*, hitherto the property of Messrs. A. M. & J. Ferguson, has been acquired by the Ceylon Agricultural Society who are now the sole owners of the Journal. This is an event on which we think we may congratulate both the Society and Messrs. Ferguson; the former on having become the owner of the foremost unofficial journal of Tropical Agriculture in the world, the latter on having successfully relaunched a great journal upon a career which we hope will be a fitting sequel to its past by achieving yet greater popularity.

We bring out this issue under the new arrangement and we wish to begin by saying that it will be our aim, above all things, to keep up the popularity of the journal by maintaining its characteristic features. The *Tropical Agriculturist* is not a journal that can confine itself to chronicling the doings of the Ceylon Agricultural Society and though the interests of the members of the Society and of Ceylon generally must come first, yet its responsibilities extend far beyond the limits of this Island; embracing indeed the whole tropic world and much of the sub-tropic.

The *Tropical Agriculturist*, was founded in 1881 by Mr. John Ferguson, C.M.G. In 1905 it became "The Magazine of the Ceylon Agricultural Society," the Director of the Royal Botanic Gardens being appointed Editor, but the Society has never owned the Journal. It has acquired it by gradual steps; a circumstance that enables us to look forward to the future with a confidence born of experience.

COMMITTEE OF AGRICULTURAL EXPERIMENTS, PERADENIYA.

Minutes of a meeting of the Committee of Agricultural Experiments held at the Experiment Station, Peradeniya, at 3 p.m. on January 9th, 1913.

Present:—The Director of Agriculture (in the Chair), The Government Entomologist, The Government Mycologist, The Government Agricultural Chemist, The Hon'ble Mr. E. Rosling, Messrs. G. C. Bliss, R. G. Coombe, G. H. Golledge, H. Inglis, N. W. Davies, F. H. Layard. J. D. Vanderstraaten and Mr. M. L. Wilkins; the Superintendent, Maha-Iluppalama Experiment Station, acting as Secretary and Mr. D. J. Blyth and Mons. Schæffer (Paris) as visitors.

The Administration Report of the Department of Agriculture and the monthly statements of accounts were laid on the table.

1. Minutes of the previous meeting of 13th November last were read and confirmed.

2. Read letter from Mr. Joseph Fraser intimating his inability to attend this meeting and at the suggestion of Mr. Golledge it was resolved that Mr. Fraser be invited to attend the next meeting.

3. Read progress report of the Experiment Station, Peradeniya. Resolved to pick the cankered pods of cacao weekly.

4. Read progress report of the Experiment station, Maha-iluppalama.

5. The Director made reference to the conference with the representatives of the Coconut Planting Industry held in Colombo on the 16th December last, and stated that the general opinion at that meeting was that a trial ground of 100 acres should be established at Chilaw.

He invited the remarks of the members present.

6. The Hon'ble Mr. Rosling and Messrs. Bliss and Vanderstraaten offered remarks, and the Committee agreed that more than one trial ground should be established. It considered that it was desirable to have two Experiment Stations of 50 acres each, one at Chilaw and the other at Galle.

7. The question of the appointment of a Sub-Committee to deal with the Coconut Experiments was discussed.

At the suggestion of the Hon'ble Mr. Rosling, it was resolved that Government be asked to appoint a number of coconut planters to the Experiment Station Committee for the purpose of forming a Coconut Sub-Committee.

8. This gave rise to the question of appointing a similar Sub-Committee on Rubber, and the Hon'ble Mr. Rosling referred to the proposal now before Professor Dunstan with reference to the appointment of a Rubber Research Committee with a Chemist who has specialized in rubber to advise them, the expenses to be shared by the planters and the Government.

It was ultimately resolved that the appointment of a Rubber Committee be deferred until Professor Dunstan could be personally consulted on the subject.

9. Mr. Bliss proposed and the Hon'ble Mr. Rosling seconded that Mr. G. H. Masefield be appointed a member of the Committee, the Director undertaking to write to Government recommending his appointment.

10. The Director read a letter from Mr. P. A. Keiller, Chemist of the Colombo Commercial Company, expressing a desire to be appointed a member of the Committee.

A lengthy discussion followed in which the Hon'ble Mr. Rosling, Messrs. Bamber, Bliss, Golledge, Inglis and the Director took part.

It was finally resolved that Messrs. Freudenberg & Co., and Mr. A. Baur should be asked whether they would like representatives of their firms to attend the meetings also.

11. The Director outlined his proposals for carrying on the experimental work of the Department of Agriculture.

He also referred to the results of Cotton trials at Maha-iluppalama Experiment Station, and to his recommendation that Maha-iluppalama be closed.

He proposed to have a Dry Zone Experiment Station and said he was in favour of its being established at Anuradhapura close to the Railway.

12. With reference to the manurial experiments on tea estates, and the question of their continuation, it was decided that they should be discontinued.

13. Mr. Bliss asked whether the Director had received any communication from the Ceylon Planters' Association regarding the sterilization of manures.

The Director replied in the affirmative, and also stated that experiments were now being carried out.

14. Mr. Petch exhibited specimens of Oxalis (Manickwatte weed), showing the small bulbs (bulbils) formed at the base of the plant. These, which are about the size of grains of paddy, were produced as buds from the old root stock. They became detached from the parent plant and lay in a cluster round it. Under natural conditions they give rise to young plants close to the old one, but when formed near the surface they may be washed away by the rain or distributed by scraping. (The plant exhibited was *Oxalis latifolia?*: *Oxalis violacea* forms the same bulbils and, in addition others at the end of short runners about an inch or two from the parent plant. Both species are included in the current references to *Oxalis* as a weed, though "Manickwatte weed" is the former. Mr. Petch said he would be glad to receive *seeds* of either species, *grown in Ceylon*, for further investigation).

15. A discussion was made on bad jat tea, and Mr. Wilkins was asked to furnish particulars regarding pruning, manuring, yield, etc., for further consideration of the subject.

16. The Director announced the impending retirement of Mr. Green as Government Entomologist. The Hon'ble Mr. Rosling proposed and Mr. Golledge seconded a hearty vote of thanks to the retiring officer.

PROMOTING GERMINATION OF SEED.

The New York Cornell Station Bulletin 312 calls attention to the fact that a certain percentage of seeds, though possessing vitality, delay or fail to germinate owing to "hardness," but that early germination could be effected by the aid of sulphuric acid. It is advisable, first to make a germination test to ascertain whether the percentage of germination of seeds, apparently alive, is low.

In the case of a small quantity of seed, it could be placed in a tube or other small glass vessel and a quantity of concentrated sulphuric acid, equal to about 5 or 6 times the quantity of seed, is poured over the seed. Stir the mixture thoroughly with a rod until all are completely coated with the acid. After standing for 15 to 45 minutes (according to percentage of hard seed) wash with water until the seed is entirely free of acid.

For large quantities a stone jar of 2 or 3 gallons capacity may be employed, and a wooden stick used for stirring.

RICE CROP PROSPECTS, 1912-13.

Final Forecast of the Rice crop in Burma for the year 1912-13.

The Commissioner of Settlements and Land Records, Burma, reports under date 6th February 1913 that the area under Rice in the sixteen Lower Burma districts is now estimated to be 7,834,803 acres, an increase of 461,704 acres over last year's actuals and an increase of 9,085 acres over the figures of this year's Fourth Forecast.

Harvesting operations are progressing normally and it is believed that in most districts the grain is threshing out well. The exportable surplus from these sixteen districts is now estimated at 2,530,000 tons of cargo rice against 2,520,000 tons in the Fourth Forecast. As in previous Forecasts it is assumed that the remaining six districts of Lower Burma will absorb 80,000 tons, while additional information obtained from Upper Burma districts confirms the estimate of 170,000 tons from that part of the Province. The total estimated surplus of the Province thus becomes 2,620,000 tons of cargo rice equivalent to about 44·4 million cwts of cleaned rice.

THE SUGAR AND RICE TRADE IN THE PHILIPPINES.

The great drought of 1912 that so shortened the rice crop of the Far East as to produce an actual famine in many districts, left its impression upon the Philippine Islands, as recorded in a recent report of the Bureau of Insular Affairs.

Under the free importation of Philippine sugars into the United States the quantity sent to this country from the Philippines is sure to increase rapidly, but the report now is that for the ten months ending October 31, 1912, only 184,000 tons of sugar were exported as compared with 194,000 tons the previous year. Under equally favourable conditions in 1912 as compared with 1911 the exports of sugar would surely have exceeded 200,000 tons.

In regard to the rice business, while the Philippines produced considerable rice, still the quantity imported is quite insufficient for their own use and during the ten months under consideration over 12 million dollars' worth were imported, all of Asiatic rice and about twice the value of the rice imported during the same time the previous year.—*The Louisiana Planter and Sugar Manufacturer*, January 1913.

INCREASING THE DURABILITY OF FENCE POSTS.

The Journal of the Board of Agriculture for January 1913 contains the following from Bulletin No. 163 of the Maryland Agricultural Experiment Station: Fence posts were treated with preservatives in various ways in 1888 and examined after twenty years. It is concluded from experiments with posts of cedar and chestnut wood that applying a preservative with a brush is not very effective; that creosote is more efficient than either coal-tar or crude petroleum; that filling in stones round the post does not increase its durability. Charring the part of the post to be placed underground was found beneficial only in the case of green posts—charring, it is stated, acting by hastening seasoning and possibly sterilizing the wood.

Experiments were commenced at the station in 1909 in co-operation with the United States Forest Service. Details of the various methods of treatment were given in this *Journal* for January, 1912, p. 850. None of the posts treated with creosote, tar, or crude petroleum show any perceptible decay after two years' use; while a large number of the untreated posts of the same kind of wood, and of the same size and shape as those that were treated, have decayed to such an extent as to make them unserviceable after two years' use. The relative durability of the untreated woods so far is as follows (the most durable are placed first): locust, chestnut, spruce, beech, maple, pine, oak, birch, sweet gum, white poplar, willow, yellow poplar, black gum, and sycamore.

MANURING TREES.

It may seem a simple thing to manure a tree, yet the great majority of people who take to the idea of helping their trees with some manure, dump a heap against the trees. The majority, of course, do not manure their trees except by accident, expecting the soil to give crops out of good nature without assistance. Bananas are commonly treated thus but the effect on such, being herbaceous plants, is to bring out roots high up, which when the heap of manure decays down are left dry and so are wasted. But on many trees, like orange and cocoa, the effect of a heap of manure placed against them is injurious. The most vital parts of such trees is the neck, that part where the roots start from the stem. The manure softens and tends to rot the bark there, encourage insects and grubs to attack the bark, while manure there can do no possible good. Trees take up their food material from all those little fine roots that start off from the large oots, and which are especially plentiful at the very end of the roots. And it is where these fine roots are that the manure should be placed, preferably in light open soils by spreading it as a mulch, and in heavy clay soils by digging the manure in and mixing it with the soil.

In mulching also, which is only a form of manuring, the mulch should not be put close to the banana, cocoa, coffee or coconut, tree root, a clear circle should be left close to the stem.

CULTIVATION OF THE LAND IN NYASALAND.

The following extract is from an article compiled by Mr. J. Stewart J. McCall, Director of Agriculture, Nyasaland Protectorate, and issued as a supplement to the *Nyasaland Government Gazette* of 31st December, 1912.

No factor has contributed more to the advancement and progress of agriculture throughout the world than improvement and multiplication of farm implements and machinery.

In practically every part of the world civilised cultivation without machinery and implements is a thing of the past and success in agriculture is largely dependent on the practical and economical use of many kinds of labour-saving machinery. It has been frequently stated that the use of inefficient tools is an economic policy at variance with the advancement of civilisation as it restricts the possibilities of land and labour and decreases their potential contribution to the human race.

The shortage of labour is the most discussed question in Africa to-day, and throughout the whole of South and Central Africa there is the keenest competition between the agricultural and mining industries, with the result that wages are being forced to such a height that agricultural operations will require to cease unless European Planters in Africa bestir themselves and economise in their labour by using more machinery.

Nyasaland is better placed than most places with regard to labour, but if our acreages under cotton and tobacco are going to extend in the future, as they have done during the last few years, those extensions, of necessity, will require to be worked by cattle, steam or motors.

If the actual cultivation and transport is carried out by machinery there should be still sufficient local labour to harvest larger crops during the dry season and add considerably to the prosperity of the Protectorate.

The writer is frequently told that implements cannot be used profitably, especially in the Uplands; with this view he entirely disagrees, and in this pamphlet will place before the planting community figures relating to the cost of actual cultivation by cattle.

In certain parts of the Protectorate the presence of tsetse fly makes the use of cattle impossible, and it may be found necessary in the first instance to open up those areas with the native "hoe" steam or motors. If South African experience may be taken as a criterion it will be found that as the country is opened up by adequate cultivation on scientific lines the fly disappears.

Preparation of the Soil for Planting.

The ideal seed-bed is deep, clean of weeds, and in a fine state of sub-division. To obtain all those conditions, the native of Nyasaland is presented with a hoe (not infrequently a worn one with a small blade) and the result is that the soil is only stirred to a depth of 2 to 3 inches; and, in the case of cotton, the surface soil drawn up into fairly large ridges, the soil between the ridges being about as hard as the soil under them, the exception being that, provided labour is plentiful, this hard pan is chopped one or two inches deep before the loose surface soil is pulled on top to form the ridge.

On most estates the soil is exposed for some weeks after ridging and before planting the atmosphere bringing about a fair state of sub-division or texture.

The principal defect in this cultivation is lack of depth, the crops being always grown on the same surface soil, either on the flat or gathered into ridges.

With a long tap-rooted crop like cotton, depth is specially important and even with the shallower rooted but more exhaustive tobacco plant, depth is advantageous, as deeply prepared fields are less liable to drought and more plant food is brought to the roots from the sub-soil.

A great deal of the surfacc washing, so common during heavy rain, is due to the shallowness of the soil, and the impervious nature of the sub-soil, especially in red clay land.

In Nyasaland where no artificial manures can be used, on account of prohibitive transport charges, the life of our estates for the profitable production of any crop will largely increase when a system of rotation and deeper cultivation by implements is practised.

The policy of continuous tobacco or cotton cultivation on the same land is exceedingly b d practice and even already tobacco lands are giving out and in time cotton plantations will do the same.

The writer realises the difficulty of getting a sufficient number of different crops to form a profitable rotation in every year of its course, but with cotton, tobacco and velvet beans (the last grown as a green manure crop) the life of our soils can be much lengthened, and the output per acre so considerably increased as to make up for no actual money return from the velvet beans.

Most of our estates are too large for the available labour supply and capital to run them, and when implements are more generally used, estates will become smaller but returns per acre will be greater, the cultivation being more thorough.

There is no question but cultivation with implements requires a considerable initial outlay of capital and for this reason a settler cannot expect to open up or maintain an agricultural estate in Nyasaland on a few hundred pounds as was possible ten or even five years ago. In those days labour was more plentiful, wages lower and no outlay on implements required, the only expense being an outlay of some £20—£30 on axes and hoes.

INSECTS INJURIOUS TO SUGARCANE.

The Curator of the Museum, Port Louis, has made a valuable contribution on this subject in a report dealing chiefly with *Phytalus Smithi* (Arrow), a comparatively recent introduction.

The pest is one of the Lamellicornia beetles and emerges after dark from its underground retreat, with the object of finding food.

The life history of the insect is fully worked out and various means of mitigating its depredations discussed. To give an idea of the extent of the damage and the expenditure on the work of destruction (chiefly in the way of premiums paid for the capture of the beetles), it may be mentioned that a 3 months' campaign over 285 acres cost Rs. 43,642, and resulted in the destruction of 1,203,518 insects.

The researches of Mr. Gilbert Arrow of the Natural History Museum have resulted in the discovery on larvæ received from Barbadoes of a parasite which is thought likely to prove useful in getting entirely rid of, or at least controlling, the pest.

The insect is of a uniform reddish colour like mahogany but the thorax is more red and the head darker.

CLOVES FROM ZANZIBAR & THE STRAITS SETTLEMENTS.

Cloves consist of the unopened flower-buds of the clove tree, *Eugenia caryophyllata*, Thumb., belonging to the natural order Myrtaceæ. The tree is believed to be indigenous to the Molucca islands, but is now commonly cultivated in many parts of the tropics, though only on a large scale in Zanzibar, Amboyna in the Dutch East Indies, Penang in the Straits Settlements, Madagascar, and to a small extent in Seychelles, Rèunion, Mauritius and Ceylon. Accounts of the results of examination at the Imperial Institute of a sample of clove-leaf oil from Seychelles and of a sample of cloves from Mauritius, have been published in this Bulletin (1908, 6, 111, and 1910, 8, 3). The quantities and values of the clove exports from some of the above localities in recent years have been as follows:—

	1908		1909		1910		1911	
	Cwt	£	Cwt	£	Cwt	£	Cwt	£
Zanzibar	133,704	264,960	181,116	330,410	114,135	253,470	Figures not available.	
Penang	4,294	11,147	1,980	5,978	1,665	7,199		
Madagascar	3,124	8,071	1,933	4,366	942	3,753	2,574	10,251
Seychelles	5½	9	¾	1,1	90	137	29	58
Rèunion	41	74	17	30	13	22	Figures not available.	

The value of cloves depends partly on the amount and quality of the essential oil (oil of cloves) they yield, and partly on their size and condition. Amboyna and Penang cloves are rich in oil and of good appearance, and for these reasons fetch the highest prices in European markets. Zanzibar cloves are nearly as rich in oil, but are usually smaller and of less satisfactory appearance and aroma, and consequently fetch lower prices. The Amboyna and Penang cloves are largely used directly as spice whilst Zanzibar cloves are utilised mostly for the distillation of oil of cloves, from which the chief constituent, eugenol—the substance to which the aroma and flavour typical of cloves are due—is then extracted, to be used as a raw material for the preparation of artificial vanillin. Zanzibar cloves are, however, largely exported to India and China for use directly as a spice.

Zanzibar.

Four samples of cloves from Zanzibar were received in October 1911. It was stated in the letter accompanying the samples that three of them had been dried by treatment in a drying machine for three or four hours at temperatures up to 80° and 100° C., and it was desired to ascertain their value in comparison with sun-dried cloves

(1) "Cloves from the Government Plantation; sun-dried on a cement drying floor." This sample consisted of very dark brown cloves.

(2) "Artificially dried at a temperature up to 80° C." Pale reddish-brown cloves with yellowish heads.

(3) "Artificially dried at a temperature up to 100° C." Cloves similar to sample No 1, but a little lighter in colour.

(4) "Artificially dried at the same temperature as No 3." This sample was similar to sample No. 2 but a little darker in colour.

Results of Examination.

The cloves were submitted to steam distillation without being crushed or ground. The yields of oil obtained, and the specific gravity of the oil in each case, were as follows:—

Sample	Yield of oil Per cent.	Specific gravity of Oil at $\frac{15° \text{ C.}}{15° \text{ C.}}$
1	16.5	1.071
2	13.7	1.071
3	14.8	1.069
4	13.3	1.066

Commercial Valuation.

The samples were submitted to brokers, who described and valued them as follows (January 1912):—

No. 1. "Good. About 5¼d per lb".

Nos. 2 and 4. "Fine, bright. About 6½d per lb."

No. 3. "Good, bright. About 5½d to 5¾d per lb."

At the same date "fair and fine bright" Zanzibar cloves were quoted in London at 5d. to 5¼d. per lb.

The brokers stated that although they had valued the artificially dried cloves at higher prices than the sun-dried sample No 1, there is not a very great demand for such cloves, and if they were marketed in large quantities the price would be lowered very nearly to that of sun-dried cloves.

It is clear from the foregoing results that some oil was lost in the artificial drying of these cloves, as all the samples dried in the machine gave a smaller yield of oil than the sun-dried sample. In view of this fact, and the brokers' remarks quoted above, it seems likely that artificially dried cloves would eventually realise no more than sun-dried cloves, and might even realise a little less, if consignments prepared in bulk were regularly found to contain less oil than sun-dried cloves, as in the case of the present samples. It is generally stated that the yield of oil from Zanzibar cloves varies from 15 to 18 per cent., but it will be seen that the artificially dried samples under report yielded less than 15 per cent. of oil. It therefore seems desirable that before artificial drying is adopted on a large scale further experiments should be made with a view to avoiding loss of oil during the process. Experiments shoud be made to determine whether the drying can be carried out at a lower maximum temperature than 80° C., and if not, whether the time occupied can be reduced.

There seems to be no reason why the artificial drying of cloves should not be accomplished without loss of oil. In Amboyna it appears to be customary to dry cloves at first on a framework over a slow wood fire, and finally in the sun. In spite of this rather crude method of drying, the Amboyna cloves are of fine quality, and yield up to 19 per cent. of oil.—*Imp. Inst. Bulletin.*

BULLETIN OF THE IMPERIAL INSTITUTE.

The fourth quarterly issue of the Bulletin of the Imperial Institute, Vol. X., No. 4, has just been issued and contains many articles of interest: the first is on "The Cotton Industry of Nyasaland." From a table showing the quantities and values of the cotton exports there has been an increase of 1,736,307 lbs. since 1902-3 when statistics were first available. A report on "Silk from Ceylon" will be found on another page of the current issue of this Journal.

Mr. Gerald C. Dudgeon, F.E.S., Director-General of the Department of Agriculture in Egypt, has contributed a lengthy article with illustrations, on the Cotton Worm in Egypt, the conclusions of which we publish in a subsequent page of this magazine.

The Bulletin contains a short review on the work of the Ceylon Agricultural Society. Reporting on a sample of seed-cotton of the "Black Rattler" variety grown in Tumpane, Central Province, Ceylon, sent for examination to the Imperial Institute in March of last year, the Bulletin says that the cotton ginned was of good, useful character and was valued at 8½d per lb. There is no regular market in the United Kingdom for seed cotton, but ginned cotton of the quality of that yielded by the present sample would be saleable in this country.

THE COTTON WORM IN EGYPT.

The following concluding remarks are from an article by Gerald C. Dudgeon, F.E.S., to the *Imperial Institute Bulletin* of December 1912 :—

In spite of the very large amount of attention which *Prodenia litura* has attracted in Egypt, the extent of the damage to the cotton crop due to its ravages is,more frequently than not, greatly over-estimated. It is quite certain that there is no year in which the whole damage can be attributed justly to the cotton worm. Many years previous to the record of the first attack of cotton worm, the boll-worm was prevalent, and the destruction of cotton by this pest has been more constant and often more severe than by the cotton worm. The cotton worm, however, is more likely to impress the casual observer, by reason of its visible multitudes, than the boll-worm by its hidden ones. It must be remembered always that, whereas the cotton worm feeds mainly on the leaves, comparatively seldom destroying buds, the boll-worm destroys buds and bolls as its chief food and is therefore generally far more injurious to the cotton crop.

CARDAMOMS.

After some years of depression, it is satisfactory to learn that the price of cardamoms this year has gone up. We take from Messrs. Schimmel and Co.'s semi-annual Report the following :—

The Cardamoms of British Commerce are all derived from *Elettaria Cardamomum*, Maton, N. O. Zingiberaceæ which grows wild and is cultivated on the Malabar Coast and Ceylon. There is a large market for the spice in Calcutta; the annual consumption in India and Burma is computed to be nearly 1,000,000 lbs. Formerly scarcely any other than Malabar Cardamoms were imported into Britain but the Mysore variety now affords most of the fine quality. The latter plant possesses a more robust habit and bears exposure better than the Malabar type. It is not known how the district name "Mysore" came to designate the variety of a cardamom plant. There appears to be two varieties of Malabar plants, var. *minus* being confined to Southern India and var. *majus* growing in Ceylon. The latter is distinguished by its shorter stems, broader leaves and more globose fruit. In the shady mountain forests of Canara, Cochin and Travancore the cardamom plant grows between the altitudes of 2,500 and 5,000 feet. The plant is best suited to a rich, moist, loamy soil protected from strong winds. These conditions are met with in the betel-nut and pepper gardens of Mysore and Canara and also in the cultivated cardamom valleys of Ceylon.

In the forest district of Coorg (Mysore) the cardamom gardens are laid out in February or March, simply by making clearings in the forest, a space of some 20 to 30 yards of jungle being left between the gardens. Superstition plays an important part, felling of the trees being only permissible on certain days of the week and before noon. The natives also believe that the presence of such plants as ebony, nutmeg and pepper favourably affect the development of the cardamom plants. In the fifth year a full crop is produced. After seven years more, the plant becomes sickly. Some of the large trees in the jungle screen surrounding the fields are felled; the falling trunks kill many of the cardamom stems, thus stimulating the rhizomes to produce new shoots, thereby renewing the producing capacity of the plot another eight years, when the process of renovation is repeated.

Methods of Cultivation in Ceylon.

In Ceylon the cultivation is carried out much more systematically. The favourite cardamom districts are Matale, Medamahanuwara and Hewaheta. The undergrowth of the land intended for a cardamom plantation is cleared, holes are dug 1½ to 2 feet wide, 12 inches to 15 inches deep and 7 feet apart in rows at a similar distance. The bulbs must not be planted too deep or

they will rot. The use of seedlings instead of bulbs is increasing, however, the Mysore variety being most frequently grown from seed. Curiously enough only a small proportion of the seed germinates.

In Ceylon the plants flower almost all the year round; picking begins at the end of August and continues until April. The fruit is carefully dried by exposure to the sun or in wet weather by artificial heat. Machines for removing the calyx tube and the stalk have been introduced, and after passing through these the capsules are graded and treated with sulphur vapour.

A table given at the end of the article shows that the cultivation of cardamoms in Ceylon has been steadily increasing. In 1911 the area and export were 7,300 acres and 564,819 lbs. In 1910 they were 7,426 acres and 639,007 lbs.—*The Planters' Chronicle.*

LAND SETTLEMENT IN SOUTH AFRICA.

During the last session of Parliament a Land Settlement Act was passed which is destined to have a profound influence on the future welfare of our country. This epoch-making law has passed into the Statute Book as Act No. 12 of 1912. By this Act the Minister of Lands is given power over any moneys voted by Parliament for closer settlement. He may purchase by auction or by private treaty, or he may exchange existing Crown land for private land.

Let us now look at the qualifications required by the applicant for a Government holding. He must be at least eighteen years of age; be qualified to utilize the land; intend in good faith to occupy it personally and work it beneficially; be of good character, possess capital sufficient to develop the holding or in any special cases possess such amount of capital as the Minister of Lands may deem fair and reasonable; and, finally, that he will develop and work the holding exclusively for the benefit of himself and the members of his family, if any. It will be noted that these conditions are not onerous. They assume a man of good character with a certain amount of money. Each holding is allotted on lease for a period of five years. During the first year no rent is required; for the second and third years, 2 per cent.; and for the fourth and fifth years, 3½ per cent. calculated on the purchase price. Every settler is required to take possession of his holding and to make it his usual abode for not less than eight months in every year. But under special circumstances, such as illness or some other good reason, the Minister can waive this clause for such period as he may see fit. Each settler has the right of purchase during or at the expiration of the five years. If not less than ten years have expired from the date of the commencement of the lease, and all instalments and other moneys due to the Government have been paid, the colonist is entitled to obtain a Crown grant. A Crown grant is the same as freehold, with the exception the Government reserves the mineral rights and certain minor matters relative to servitudes, roads, outspans and the payment of taxes. A settler may at any time pay in sums of over £ 100 to the credit account of the purchase price of his holding. But if, on the other hand, he does not wish to secure a Crown grant on the completion of his ten years, he can continue half-yearly payments at 4 per cent. for twenty years, which added to his first five years' lease, will enable him to obtain full title to his farm after a period of twenty-five years. If there are no improvements on his holding at the date of allotment, the settler must make improvements to the value of 10 per cent. of the purchase price of the farm during his five years' lease. That is to say, in the case of a farm worth £ 1,500, he must carry out improvements to the value of £ 150.—*The Agricultural Journal of the Union of South Africa.*

PROGRESS OF CANE CULTURE IN THE PHILIPPINES.

The Bureau of Agriculture, organized by the Insular government of the Philippines, has recently made its annual report on the development of agriculture along modern lines in the Philippine Islands. Special attention has been given to the sugar industry and modern methods have been followed with a view of changing over the manufacture from the antique methods shown in the Philippine Exhibit at the St. Louis-Louisiana Purchase Exposition in 1904, to the modern methods with first class central factories and carefully selected sugar canes cultivated after our modern American methods.

It was reported that six Hawaiian varieties of sugar cane are now being tested as well as various local canes and there is every reason to believe that with ordinary effort the old sugar culture of the Philippines, which once reached nearly 250, 000 long tons, will quickly surpass that and go on to an indefinitely large production, so long as the industry pays, and the labour supply does not give out.

At La Carlota experiment station about 100 acres of sugar cane were grown, which produced about 150 long tons of sugar. This acreage comprised some 12½ acres of second stubble, 17 acres of first stubble cane and about 70 acres of plant cane.

The yield of cane seems to have been about 10 short tons per acre, this making rather a poor showing for a tropical country, but we have no doubt that some adverse influences were prevailing.—*The Louisiana Planter and Sugar Manufacturer.*

DEPARTMENT OF AGRICULTURE, MADRAS PRESIDENCY.

The report of this department for 1911-12 is issued by the Acting Director, Mr. G.A.D. Stuart, and to it are annexed those of the Deputy Directors, the Principal of the Coimbatore College of Agriculture, the Chemist, Botanist, Mycologist, and the Honorary Director of Fisheries.

There is a good deal of information about paddy which should prove of local interest. At all the farms the great value of green manuring was demonstrated. The leguminous crops grown were *Sesbania aculeata*, *Crotalaria juncea*, *Phaseolus mungo*, and *Phaseolus aconitifolius*. The yield of paddy at Pallur Farm was practically doubled as the result of green manuring. Sesbania yielded as much as 14·7 tons of green matter per acre at Samalkota.

As regards seed rate it was conclusively proved that 20 lbs. of grain sown thinly in a seed bed was sufficient to provide seedlings for planting out an acre, and that an acre so planted will yield more than if 120 lbs., of seed is used.

The practice of single seedling planting is spreading rapidly, and it is expected that in a few years more it will become practically universal, so that the saving in seed paddy alone will be represented by 300 million lbs., worth say a hundred lacs of rupees per annum.

TYPES OF FELLAHEEN OUTSIDE THE AGRICULTURAL BANK.

AN EGYPTIAN VILLAGE.

YAM GROWING IN JAMAICA.

Mr. R. C. Somerville, Agricultural Instructor of the Jamaica Agricultural Society, has written the following article to the *Journal* of that Society for December 1912:—The yam tuber takes the foremost place of all the vegetable foods grown in Jamaica in the diet of the labouring classes. In spite of all that may be said to the contrary, the fact remains that our most robust and hard working labourers in the country parts are those whose fare consists, has always consisted in its greater bulk, of yams.

In every parish the article is grown to a greater or less degree; but the methods of planting and cultivation differ considerably in different parishes and districts. I have grown yams in five parishes and in all of these the methods of cultivation was different, this being due to variations of climate, rainfall, altitude, soil and the breeds of yams to be planted.

It ought then to be interesting to the yam grower of South Manchester, who has to flypen his plot, dig large and deep hills, and mulch heavily after planting, and to the Upper Clarendon yam grower wh cuts down woodland for his new ground to know something of the methods obtaining in Hanover, the premier yam growing parish of the Island.

All over Jamaica the name of Hanover is associated with the yams shipped from Lucea. The Lucea yam, or as it is called in Hanover, "Doctor Dick," (probably because it is so wholesome) is a variety of the negro yam. Like the famous Hanover Criollo cocoa, it thrives best in Hanover although giving satisfactory results in Upper St. James and Westmoreland and some parts of Portland.

Its leaves are like the ordinary negro yam only of a deeper and richer green and the vines are spiny and have to be carefully handled.

The tubers are long and smooth and rarely bear "toes" except they meet on stones or very hard earth; this quality makes packing easy and renders to a minimum the risk of breaking during transport of this brittle article. They are white when cooked, are mealy and so are easily mashed for table use. They keep without wilting or decaying for a considerable time after they are taken up and this is the quality that makes them so valuable for shipment to Central America and other near by places. Upper Hanover consists of steep mountain ranges and deep glades with here and there a comparatively level tableland. These mountains are, for the most part, large mounds of alluvial soil and it is along the sides of these steep slopes that the great yam fields are to be found.

One can hardly imagine a more beautiful sight than these extensive yam fields along the mountain slopes. I remember the Travelling Supervisor of Instructors growing delighted over some of these while climbing the hills to Cascade.

The thick ruinate is cleared away and burnt in heaps. Then where the land is very steep, zig-zag ridges or paths are cut so as to give the workers a foothold, then the digging of the hills is started at the bottom, each row of hills forming a sort of catchment for the loose soil of the upper row. A good worker can dig upwards of 150 hills per day, his pick-axe sinking at each stroke into the soft soil. The hills are dug very close together, an acre holding 2,000 hills. Two "bits" each with an eye are planted in each hill.

The "Doctor Dick" requires tall sticks, one being put to two hills. The fields are weeded twice before harvesting. The average yield per acre is about 4 tons, but with very favourable conditions of soil and season as much as 6 tons can be reaped.

This at £8 per ton is a good reason why the Hanover yam planter will always stick to his business. I shall go into the cost of planting and reaping one acre of yams in Hanover.

	£.	s.	d.
Rent for one acre	1	0	0
Cutting and cleaning at 4s. per chain	2	0	0
Digging yam 2,000 hills at 2/6 per 100 including planting	2	10	0
2,000 sticks at 1s. per 100	1	0	0
Sticking out yams at 6d. per 100	0	10	0
Two weedings at 10s. per acre	1	0	0
Total cost ...	£. 8	0	0

I have left out the cost of buying plants as that once done, the grower will always have enough to plant and sell and thus make up his outlay.

The yams are sold in Lucea at £8 per ton, bringing a gross increase of £32.

If an additional £4 be put to the expense for carting, it will still leave a profit of £20 per acre.

Many planters have fields up to 25,000 hills. The reader will have an idea of the volume of the yam trade when it is known that during the two weeks previous to the Lucea show in August over £1,000 worth of yams were shipped to Kingston and foreign ports from that place, and this does not include the 35 to 40 cart loads sent weekly to Montego Bay, Savanana la-Mar and Black River, and the large quantity sent from Green Island in boats to the neighbouring parishes.

The Hon. G. L. Santtleben, Custos of the parish, himself the largest yam merchant in the west, said in his opening speech at Lucea that the yam industry meant an income of £40,000 annually to Hanover and he ought to know.

It must not, however, be imagined that the "Dr. Dick" is the only yam planted in Hanover. The "Afou" or yellow yam is largely grown. This is planted even closer than the "Doctor Dick" an acre being made to hold 2,300 or more hills.

This yam requires short sticks so as to keep the soil cool. It is a great favourite in the local markets although it will not keep long and is therefore useless for foreign trade.

This yam comes in during the fall and meets a good market ranging from 8s. to 12s. per cwt. The itinerant yam buyers purchase "Afou" yams in the field at £2 to £2 10s. per 100 hills, head and all, and trust to luck for their profit which is sometimes considerable, while at other times they find that the hills have not borne and they lose. The yam lands are in most cases too steep for bananas although having beautiful soil, but so long as yams will sell, and there is no reason why they should not, the industrious planters of Hanover will never cease to turn to good account the inexhaustible resources of the hill lands of this fertile little parish.

AGRICULTURAL PROGRESS OF ARGENTINA.

RECORD MAIZE CROP.

Aided by the plentiful rains and immunity from locusts, the maize crop has been the finest ever seen in this country. This year's bounteous yield is estimated at 7,515,000 tons, of which some 5,000,000 tons should be available for export. The grain is a good quality and with the present brisk demand in Europe, a good business should result. The shipments of cereals during the first half of 1912 have reached 3,000,000 tons as against 2,570,000 tons during the same period of the preceding year. Some 2,000,000 tons are still left for export.

The estimated export surplus for 1912 is as follows:—

Wheat and flour	...	...	3,000,000	tons
Linseed	...	...	500,000	,,
Maize	...	...	5,000,000	,,
Oats	...	...	850,000	,,

The acreage sown was as follows:—

			1910-11 Acres	1911-12 Acres
Wheat	...	...	15,633,000	17,242,000
Linseed	...	...	3,759,000	4,075,000
Maize	...	...	8,038,000	8,555,000
Oats	...	...	2,003,000	2,577,000

The increase in the area under maize is somewhat unexpected in view of the scarcity of seed, due to the complete failure of the 1911 crops of that cereal.

When the statistics for 1912 of the world's exports of maize come to be published, Argentina will probably be found at the top of the list of exporters of that cereal for the second time. The Republic attained that position in 1909, when with a production of only 4,500,000 tons, the exports reached 2,273,400 tons as against this year's production of over 7,000,000 tons, of which no less than 5,000,000 tons are available for export during the current year. In 1909 the United States, Argentina's most formidable competitor, were only able to export 1 per cent. of their huge maize harvest of 75,000,000 tons.—*The Indian Trade Journal.*

THE BRITISH COTTON GROWING ASSOCIATION.

Mr. Asquith, in replying to the deputation sent by the British Cotton Growing Association, said he and his colleagues were very glad to have had the opportunity of meeting so very representative a deputation, and of listening to the case which had been so clearly and forcibly laid before them by the speakers. His Majesty's Government had long had under consideration the very important questions upon which the deputation had spoken with such special opportunity of knowledge. When he was at Malta sometime ago for another purpose he had the opportunity of several conversations with Lord Kitchiner, who laid before him certain facts which the deputation had represented. As they were aware, Lord Kitchiner was an ardent supporter and advocate of their views, and all the facts which had been laid before them had been considered by the Government, and they had certainly come to the conclusion, particularly as regarded the Gezira Plain, that the prospect of its utilisation—what he might call its economic utilisation—as a

place for cotton growing, were as great as any other unexploited part of similar size or situation. It was a matter of interest to the whole of Great Britain, and, indeed, to the Empire, that we should both multiply our possible sources of supply of raw cotton and enlarge the area upon which it was grown; and being, as we were, so largely interested not only in the cotton industry at home, but in the development of the Soudan itself, of which we had now acted as trustees for a considerable number of years with very striking results in the economic progress of the country, the Government approached the consideration of such plans as the deputation had placed before them with sympathy and the utmost possible prepossession in their favour. "We have given," said Mr. Asquith, "careful consideration to the matter, and I am glad to be able to inform you that it is the intention of the Government at the earliest possible opportunity next Session to introduce a Bill, the draft of which is here, which will authorise the Treasury to guarantee the payment of interest on a loan to be raised by the Government of the Soudan to the extent of three millions—(cheers)—for a number of purposes which are enumerated in the schedule, and which without committing myself at this moment to precise details, will carry out generally the suggestion you have made today. We are satisfied that the Government, in giving that guarantee, will not be imposing on the British taxpayer what is likely to be a serious or even appreciable burden. We are, at any rate, prepared to run that risk and trust that all parties will join us in giving a rapid passage to a measure of such importance."—*The Financial Times.*

PLANTING COCOA.

The following notes have been contributed by Mr. A. H. Hoare to the *Journal of the Jamaica Agricultural Society* of December 1912:—

The young cocoa plants will succeed best if planted out through bananas, as they must have a certain amount of shade from the hot sun when young and the banana will answer satisfactorily for that purpose and enable the cocoa to be grown economically. Moreover, if the bananas have been properly cultivated the land will be already in good condition and will need no further preparation before planting. See that the land is properly drained, especially if it is inclined to be wet or if it is of a stiff clayey texture, otherwise the soil becomes in wet weather sodden and sour, and cocoa trees will not thrive when the soil is water-logged and sour. Choose land that has a good soil, deep because the trees send down a tap-root which although not assisting to feed the tree to any great extent, will greatly affect its health if it comes into contact with an impenetrable bed or marl or rock.

Avoid bleak, windy situations, for cocoa trees love shelter and suffer greatly from the effects of strong winds which cause defoliation and also injury to the tender young shoots. Valleys sheltered by hills aud rocks, and stretches of land protected by good belts of timber are ideal situations if in a good rainfall.

Do not follow the examples of others and plant too close, for cocoa trees need light and air in abundance, and will never pay for over-crowding. On good rich land I would advise planting 12 to 14 feet apart in the rows and on poorer soils or on hillsides where the trees will not grow so big 11 or 12 feet apart will not be too close. At these distances the trees should almost touch when fully grown and there will be ample space for the free circulation of light and air so needful for healthy growth of the trees and full crops of pods. In addition, the trees will shade the ground nicely, keeping it cool and moist and also preventing an excessive growth of weeds. Of course the distance between the rows will depend on what distance the bananas are planted, as the row of cocoa trees will run between each row of bananas.

First, line out the rows methodically, and place a peg where each hole is to be dug. Large holes should always be dug to receive the plants and I strongly urge the digging of them about not less than a fortnight to three weeks before planting. Good holes are important. They should be made at least two feet square and eighteen inches deep and the soil must be well turned out so as to expose both soil and hole to the beneficial action of sun and air. Then, just a few days before planting fill in the hole with good surface soil, making its surface a little higher than the surrounding land to allow for sinkage. Unless this precaution is taken when the ground sinks there will be a depression round the plant in which water will settle and cause the stem to rot away.

Transplanting.

When putting out plants grown in bamboo pots, great care must be used so that the plant shall receive as slight a check as possible in transplanting. Take care to see that the soil in the pot is well soaked before removing the plants. I advise placing them for a few minutes in a pail of water to soak and standing them aside to drain. When actually planting, the pot should be taken into the hand and carefully split open by making a cut at each side with a cutlass. Next, neatly reverse the two halves of the pot, make a good hole in the loosened soil with the hand and insert both pot and plant carefully. Do not plant too deep or too shallow, but sink the pot until its top is level with the surface, pressing in the soil round it. Then gently withdraw the two reversed halves of the pot making everything quite firm and tidy afterwards.

The great advantage of preparing a good deep hole and careful planting is very soon apparent, for the plant makes a good start in the sweet loosened soil and grows away at a vigorous rate. One cannot too heartily condemn the slip-shod method often adopted of simply chopping a hole with the hoe, pushing in the plant with perhaps all the soil shaken off its roots, and then leaving it to take its chance. It is hardly to be wondered at that most of the plants, instead of progressing, gradually die out until the cultivator who put out a hundred plants eventually finds that he has only a dozen or so growing plants left. By following this simple but very safe method, every plant should grow and in a few years form a uniform and profitable plantation.

In conclusion, I might mention the time-saving plan of always keeping back a few plants in pots so that in the event of any dying out, they can be renewed at once.

THE COTTON INDUSTRY OF NYASALAND.

The introduction of cotton-growing into Nyasaland is of comparatively recent occurrence, a few consignments being exported for the first time in 1902; but already a large industry has been worked up, the rapid growth of which may be judged from the following table showing the quantities and values of the cotton exports since 1902-1903 when statistics were first available :—

		Quantity lb.		Value £.
1902-3	...	692	...	No complete returns.
1903-4	...	56,897	...	1,778
1904-5	...	285,185	...	5,941
1905-6	...	776,640	...	16,180
1906-7	...	526,119	...	15,345
1907-8	...	403,486	...	13,998
1908-9	...	756,120	...	28,355
1909-10	...	858,926	...	26,209
1910-11	...	1,736,999	...	58,687

In the early days of the industry all kinds of cotton were grown, bu many of these were unsuited to the climatic conditions of the Protectorate ; and owing to the different varieties being grown in proximity hybridisation was common, resulting in the deterioration of those types which, under proper conditions, would have given good results. The only types now grown on a commercial scale are Egyptian varieties, which are confined to the warmer districts of the Lower river, and long-stapled American Upland forms, which are cultivated only on the higher lands. As a general rule Egyptian cottons are grown in Nyasaland at elevations below 2,000 feet and the American kinds from 2,000 to 4,000 feet.

By careful selection of "improved" American Upland varieties, a type of cotton has been evolved which has now become acclimatised and is recognised as a distinct commercial variety under the name of "Nyasaland Upland." At the present time this cotton is regarded as the best grown in Nyasaland from Upland seed, and is valued at 2d. or more above that of "middling" American of the total area under European cultivation in the Protectorate in 1912, 23,300 acres were devoted to Nyasaland Upland and 755 acres to Egyptian cotton.—*Imp. Inst. Bulletin.*

SILK FROM CEYLON.

The following report is from the *Imperial Institute Bulletin* on two samples of silk, produced and reeled at the Peradeniya Silk Farm, and which were sent for examination at the Imperial Institute in January 1912:—

No. 1.—"Product of the Mysore silk-worm." This consisted of a skein of silk of pale fawn colour with a greyish tinge. The silk was clean, but of unsatisfactory colour.

No. 2.—"Product of a hybrid between Mysore and Bengal silkworm." This sample consisted of a skein of golden-yellow silk, with a high lustre resembling that of Italian silk, but was rather dirty and specky.

The silks were examined with the following results :

	No. 1.	No. 2.
Moisture, *Per cent* ...	9·3 ...	9·9
Loss in weight on degumming with a 1 per cent soap solution, *Per cent* ...	26·1 ...	21·9
Colour and lustre after degumming.	Pure white & highly lustrous.	Cream coloured & highly lustrous.
Titre (size of fineness) ...	17 to 19 deniers. Average : 18 deniers (international)	Irregular : 15 to 20 deniers. Average : 17·5 deniers (international)

The samples were submitted to a firm of spinners, who described them as marketable silks, and valued No. 1 at about 12s. per lb. and No. 2 at probably 12s. to 13s. per lb., with East Indian Surdah silk at 11s. 3d to 11s. 9d per lb. The spinners expressed their willingness to carry out practical trials with large samples of these silks, in order that their value might be accurately ascertained.

THE MOSQUITO PLAGUE OF THE CONNECTICUT COAST REGION AND HOW TO CONTROL IT.

The mosquito plague of Southern Connecticut is composed chiefly of two species of salt marsh mosquitoes—the brown salt marsh mosquito, *Culex cantator* Coq., and the banded salt marsh mosquito, *Culex sollicitans* Walk., which breed in the brackish stagnant pools of the salt marshes and fly inland several miles in search of their food, viz., the blood of the higher animals.

The rain barrel mosquito *Culex pipiens* Linn. breeds in rain water barrels, tins, cans and other receptacles along the shore, and certain other species of *Culex*, as well as the malarial mosquito, Anopheles, may breed in the fresh water pools next to the highland, yet these are all local, fly only short distances and form only a small part of the mosquito plague of the coast region.

The salt marsh region of Connecticut contains 34·79 square miles, or 22,264 acres, more than half of which has in past years been drained for salt hay farming. During recent years the marshes have received little attention, the ditches have become filled and probably breed more mosquitoes than they did thirty or forty years ago.

The conditions are such as to check the proper and natural development of the Connecticut coast region as a site for summer homes; the land produces little, and is unprofitable, yet taxes are collected upon it.

Tide gates in proper working condition will keep tide water from flowing over the marsh but do not prevent the fresh water entering the marsh from the highland. This must escape to the ocean and draining is the only treatment to be advised. Narrow deep ditches are much more permanent than broad shallow ones. The lateral ditches should be not more than ten inches wide and from 24 to 30 inches deep, and placed from 100 to 150 feet apart, running parallel with each other, and nearly at right angles to the main stream or the broad central ditch.

The cost of draining the Connecticut marshes will vary, but may be done by contract at from $5·000 to $10·00 per acre, and should not average more than $8·00. The entire salt marsh area of Connecticut can be drained for less than $200,000,00.

The increase in yield of salt marsh hay will soon pay the cost of draining and may do so in a single season.

Mosquito wrigglers may be killed by oiling the breeding pools, but this should be considered as only a temporary measure and should not be advocated in place of draining.

Co-operation of individuals and communities are necessary for successful results in this work, and many towns and communities have taken it up. Legislation, however, is needed, and a State-wide movement with some State supervision would seem to be the best solution of the problem.—*Report of the Connecticut Agri. Exp. Station.*

PADDY CULTIVATION IN CEYLON DURING THE XIX CENTURY.

By E. ELLIOTT.

(Continued)

The outlay on each class and acreage served are as follows:—

		Construction Rs.	Maintenance Rs.	Acres served.
1.	Major Works	1,290,986	595,961	61,607
2.	do do	4,311,260	952,666	59,296
3.	Minor Works	455,150	61,771	9,187
4.	Village Tanks	380,688	37,026	165,372*
	Total...	6,438,084	1,647,424	295,462

The 1st class works repaying entire cost of construction are almost entirely in the Eastern Province, where 5/6ths of the area benefited is situated. The average cost per acre served under Rs. 21/- was low, as the extent under many of the works were large, old works were to some extent utilised and very limited provision for distribution made. Notwithstanding these drawbacks they have proved a great success and while profitable to the cultivators, have likewise paid Government handsomely to an extent not generally known or realised. Out of the entire cost of construction and maintenance Rs. 1,886,945 (to end of 1906) there has been recouped to the Treasury by repayments Rs. 383,766, by rates for maintenance Rs. 62,808 and by sales of waste land (otherwise practically of no value), Rs. 695,536, making a total of Rs. 1,142,109. But to these has to be added the revenue from the increased tythe received prior to abolition and which amounts, as already stated, in the Eastern Province alone to Rs. 895,000. Consequently the total direct return in money to Government has been over 2 millions of rupees or an excess of over Rs. 150,000 to the end of 1906. As since that steps have been taken to recover the current cost of up-keep from the lands served, this credit balance remains unreduced.

In Kalutara also the outlay has been even more remunerative to Government, viz., Rs. 18,771 for construction and maintenance as against a return of Rs. 31,185, over half contributed by the sale of the waste land benefited.

The 2nd class works, benefiting lands liable to repay a rate of Re. 1/- per acre in perpetuity, are chiefly in the Southern (where half the whole extent is situated), the North-Central (where 1/5th lies) and the North-Western (about $\frac{1}{8}$) Provinces.

The lands served in these localities are much more broken and the surface more irregular than the Eastern Province plains, and the tracts smaller and more scattered. Consequently long channels of distribution were required and largely provided (which they were not in Batticaloa) and this increased the cost to an average of Rs. 75/- per acre, and the upkeep is correspondingly high.

* This includes 96,915 in the North-Western Province and 46,363 in the North-Central Provinces mentioned in the Director's report but omitted from the "general Irrigation Return."

On the other hand the easier alternative terms were originally granted by Sir W. Gregory in the belief that, supplemented by the additional value of the Government share of the increased crops, a satisfactory return on the outlay would be forthcoming *in perpetuity*. This it did undoubtedly in the Matara district as already explained, and there was a promising return growing up in the North-Central and North-Western Provinces and elsewhere, but expectations of this nature were destroyed by the abolition of the so-called grain tax in 1892. However, before this was accomplished there undoubtedly had been a considerable return from this source, which in the two districts specified alone amounted to about Rs. 730,000.

Other recoupments on account of this class to the end of 1906 were: Rates Rs. 602,557 and Land Sales Rs. 371,041, making a total of Rs. 1,703,590, while the total expenditure for construction and upkeep has been Rs. 5,263,926, inclusive of a sum of Rs. 185,462 expended on the Kirema and Urubokka Dams constructed in Sir Henry Ward's regime, which however may be taken as entirely repaid by the sale of the Government lands, which fetched very high prices in the sixties and aggregated a considerable sum, supplemented by the increase in the Government tythe exact figures of which are not available, and have never been included in the General Irrigation returns.

On Minor Works the outlay has been Rs. 455,150 on construction and Rs. 61,769 on maintenance, making a total of Rs. 516,919 benefiting 9,187 acres, an average of Rs. 56/- per acre. Under this head are classed several schemes which have not fulfilled the expectations hoped for, such as the Devitura dam (S.P.) costing Rs. 74,862, and executed in Sir H. Ward's time. Other disappointments were Munèsweram Channel (Chilaw) costing Rs. 27,456, and Elahera (Matale) Rs. 55,382.

It is also inclusive of Rs. 95,661 expended with Sir A. Gordon's approval, on the Bodiela and other works in Walapane (Nuwara Eliya district) with the intention of affording relief to a poverty-stricken district. A further expenditure of Rs. 32,000 in the lower parts of Uva was due to similar considerations. In fact nearly the whole of the expenditure was what in India would be classed as "famine relief" for which no return was ever expected, and after all it only amounts to under 8 per cent. of the total outlay on irrigation during the 50 years under notice.

On Village Works the expenditure has been exceedingly moderate, viz., Rs. 380,688 on construction and Rs. 37,026 on maintenance (to end of 1906), the acres benefited being 165,372 acres, of which 96,615 lie in the North-Western Province, 46,883, in Nuwerakalawiya and 12,443 in the Wanni of the Northern Province.

Rs. 2·71 per acre is consequently the outlay by Government on the necessary masonry, appurtenances and supervision, the required earth works having been executed by the land owners. Of the aggregate value of these contributions no figures are available, but Sir West Ridgeway mentioned in his farewell address to Council that during the four years (1908-12) the earth-work done in the North-Western, North-Central and Northern Provinces alone amounted to over 1,364,000 cubes, and that the annual value was about Rs. 225,000 and the cost of supervision Rs. 52,000.

Since the organization of a subordinate staff to attend to this branch under the supervision of the Government Agents, the villagers' contribution has been materially increased, and amounted in the three years (1905-07) to 1·45 million days labour, which the Director values at Rs. 725,000, in addition to an expenditure of Rs. 73,288 from the accumulation of fines imposed under the Irrigation Ordinance. The number of village tanks worked on is 3,683, the great majority of which had been completely restored, of which 1,116 are in Kurunegala district, and 1,559 in the North-Central Province.

In regard to these tanks the present Director of Irrigation has recently recorded :—"Some have quite large storages and are a record of many ages of heavy labour on quasi-public works. The amount spent by the (present) general tax-payer has been very small in proportion except in the matter of supervision. Mr. Strange (the Indian expert who recently reported on Irrigation in Ceylon) specially remarked the excellent order in which village tanks were kept as a rule. The open vote for the whole island is only Rs. 9,000."

(To be continued.)

FRESH FACTORS IN WATTLE GROWING.

The following article is from the *Agricultural Journal of the Union of South Africa* for January 1913 :—In a recent number of the *Journal* we discussed the early history of wattle growing, and during our recent visit to Natal we took the opportunity of visiting the famous centre of the industry, namely, Harden Heights an account of which we shall reserve for a subsequent issue. Meanwhile, we propose to speak briefly of those factors which progressive growers deem essential to the future success of the industry. For this information we are indebted to Mr. Duncan M. Eadie, the courteous and energetic secretary to the Natal Agricultural Union. During the past few years handsome profits have been made out of wattles, and as a result much more land has been placed under cultivation. Thus there has been a large increase in the output, but at the same time a fall in the price. It is stated, however, that the fall in the price of wattle bark is out of all proportion to the fall in the price of other tannin materials, probably caused by a change in the practice of tanning. Up till a few years ago raw bark was used in the tan pits. Nowadays, the tanner employs tannic acid in the form of a liquid extract from the raw material. Again, it is well known that wattle bark is sent chiefly to Germany and there turned into extract. This is a profitable enterprise for the German manufacturers owing to the fact that a heavy import duty is imposed on foreign extracts, whereas raw bark is admitted free of duty. But it does not seem feasible that wattle bark can be imported into countries except Germany and turned into extract at a price that will compete with other imported extracts unless there is a still further reduction in price in the country of origin, namely, Natal. To bear this reduction, and at the same time to ensure a market for this South African product, some radical changes in industrial practice must be made. These are the fresh factors of which we shall speak.

In the first place, there must be some improvement in the packing of wattle bark. In the past, wattle growers have been fortunate in having a freight rate of 25s. per ton of 2240 lb. between Durban and the chief European ports, that is to say, 27s. 3d per long ton when port charges are added. With the completion ot the last mail contract it was proposed to charge bark by cubic measurement. Under these new conditions a long ton of bark would cost 32s. as against 27s. 3d. as at present. This led to a protest on the part of the growers, but better still to a systematic inquiry as to whether wattle bark might not be pressed into rectangular packages instead of filling sacks as is done at present. This proved successful, and there is but little doubt that within a short time bark will be shipped at a rate equal to 15s per long ton, or a saving of 12s. 3d per ton.

The second factor to be considered in the new wattle industry is the manufacture in Maritzburg or Durban of wattle extract. Should the average price of bark fall below £5 per ton on the plantation, and this depression is maintained, a state of affairs may well arise which will render the manufacture of wattle extract more profitable than the export of raw bark.

There seems no good reason why a wattle extract factory should not be erected in Natal which would prove as successful as the sugar factories now in operation. A third feature of the wattle industry is the disposal of the wood. A conservative estimate places the quantity of wattle timber annually available at a million tons. Owing to the hardness of the timber it is unsuitable for ordinary industrial purposes, and its small diameter debars it from being widely used as mine timber. A device for binding together the small trunks into a good sized pillar has recently been invented, and the resulting poles, after practical experiment in a Johannesburg gold mine are said to be quite efficient. But when all is said and done the present methods are wasteful to a shameful degree. It is to be hoped that wood distillation may be commenced in the near future with the object of producing acetate of lime as a main product and charcoal and tar as by-products. Summing up, we may say that the wattle industry has a great future. New conditions must be made by new methods. The wattle farmer of the future must be a world farmer.

INDIA RUBBER.

THE WATERING OF TAPPING CUTS.

The following notes on the watering of cuts have been written by a planter who prefers to remain anonymous and is published in the *Agricultural Bulletin of the Federated Malay States.*

In some systems of tapping Para rubber trees, the latex often has to travel a distance of many feet from the point at which it exudes from the bark until it reaches the spout from which it drops into the collecting cup. It would apparently be advisable to pour a little water at the top of each cut to help the latex on its journey.

A large number of estates however have now adopted the "single V" system of tapping. Using this system it is practicable to affix the spout in the tree within a few inches from the bottom of the excision, and the latex has not to flow a long distance before it drops into the cup. It is still however a common practice to pour water on the cuts.

One argument in favour of this practice is that in the case of some trees and at some seasons of the year the latex coagulates on the cut without running, and if water is poured on the cut, a certain quantity of latex, at all events, is carried into the cup. It is true that a quantity of latex will be carried into the cup sufficient to make the water opaque, but if such water or latex (whichever one chooses to call it) be examined, the amount of rubber contained in it will be found to be small: a rubber estate that relies for its output on the quantity of latex washed down into the cups in this way will scarcely create fresh records of production: the big outputs are obtained from fields where a fair proportion of the trees go on dripping for an hour or more after they have been tapped.

Again it is argued that pouring water on the freshly excised cut tends to retard the coagulation of the exuding latex. The bark excision may be likened to a surface cut in human flesh: in the latter case the blood flows out until it coagulates and thus forms a scab which heals up the wound: so in the case of a rubber tree the latex appears to exude until, solidifying, it chokes up the lactiferous tubes and forms scrap. A small quantity of water is often poured into the cups in order to prevent the latex coagulating before it is lifted to be taken to the factory: and it is true that, when latex drips into a

dry warm cup, it does tend to coagulate when it comes in contact with the surface of the cup. So, if one puts water into the cups to retard coagulation, it seems fair reasoning to assume that water poured on the cuts will also retard coagulation.

Observation appears to show that on rainy mornings, when the bark is wet, the latex tends to clot more quickly, even though the spouts go on dripping for quite as long if not longer than usual. If however the milky fluid that is dripping down be examined sometimes after the tree has been tapped, it will be found to contain very little latex: on a dry morning on the other hand the last slow drops that fall with perhaps an interval of several minutes between each will be found to be particularly rich in rubber, just as the strippings of a milch cow are rich in butter fat.

Some planters are beginning to question the advisability of watering the cuts, and carry out experiments on the subject. I now record the results of a couple of experiments initiated by me. It is not for one moment claimed that these conclusively settle the question, but they are put forward in the hope that other planters may thereby be induced to record similar experiments for comparison.

In the first experiment two adjacent trees were selected, both the same size, the same age, and in no way abnormal. They were both twenty-five inches in circumference at three feet from the ground, had been tapped for about twelve months on a single V, and the tapping was as nearly perfect as it is possible to get tapping. One had been tapped to within six inches from ground level and the other an inch or so less. Every day for a month the time was noted when each tree was tapped and when it ceased to drip. For half the month the drops of latex from one tree were dotted down and counted, and for the other half of the month the drops from the other tree were similarly counted. The cuts on these trees were watered on alternate days, so that each day one tree was watered and the other left to run without assistance. At the end of the month the results were averaged out, omitting days that were in any way abnormal. Dealing in round numbers it was found that, when the cut was watered, the tree continued to drip for eighty-one minutes, when the cut was not watered, for one hundred and two minutes: that when the tree was watered it yielded 250 drops, when not watered 510 drops.

In considering these results it must be remembered that, when water was poured on the cut, the latex then on the cut was all carried down into the cup, and for a short period latex would discontinue to drop. The latex flowing down with the water would not be counted in, so that the difference would really be less than is shown by the figures obtained by counting the drops. On the other hand the careless application of water in practice often causes a certain amount of rubber to be lost owing to the latex spilling from the cut and trickling down the bark of the tree.

The second experiment was carried out on two lots each comprising nine hundred trees. These trees are young, only recently opened for tapping, and the field does not ordinarily give a big yield. Only No. 1 latex was included: scrap and cup washings were disregarded as being constant factors. The first lot of nine hundred trees, tapped for a period of five days with water poured on the cuts, gave a total output of sixteen pounds: tapped for a further period of five days without water being poured on the cuts, it gave an output of eighteen and a half pounds. The second lot of nine hundred trees tapped for the first period without water gave an output of twenty-four and a half pounds: tapped for the second period with water it gave an output of twenty and a half pounds.

This would appear to show that one thousand trees would give about three-quarters of a pound less rubber a day if water were poured on the cuts than they would give if the cuts were not watered.

A VIEW OF KANDY
Headquarters of the Ceylon Planters' Association

A VIEW FROM THE ROYAL
BOTANIC GARDENS, PERADENIYA.

THE RESIDENCY,
(Old Palace), Kandy, Ceylon

POSSIBLE RUBBER PRODUCERS IN THE TEMPERATE ZONE.

By CHARLES P. FOX.

While the production of rubber in the temperate zone has been regarded as possible its probabilities are remote and dependent on many conditions. Some of these are: demand; cost of production; grade of product; influence of supplies of natural and plantation rubber; and the ever recurring spectre of synthetic rubber.

From his investigations extending over fifteen years, the author has found several rubber producing plants suitable for the various sections of the temperate zone. Among foreign plants were *Atraclylis and Eucommia*, the most interesting specimen being *Eucommia ulmoides*, or "Chinese Rubber Tree" said to be hardy in New England. This source of rubber was found only suitable for ornamental forestry. Of native plants, those of possible value as rubber producers are members of the *Asclepiadaceæ*, *Apocynaceæ* and *Compositæ* families.

Of the true milkweeds, only one is of any importance, *Asclepias Cornuti*, which is very abundant and contains a quantity of milky juice producing 3 per cent. of fair grade rubber. The cost of collecting the latex is, however, prohibitory. The common India hemp, *Apocynum Cannabium* is less abundant than milkweed and produces less latex, but the quality of the rubber is better. The third native group named, that of the *Compositæ*, include *Souchus* or Sow-thistle, producing an excellent grade of rubber, which is the subject of a German patent of 1885. It grows on a dry barren soil.

Two species of wild lettuce, *Lactuca Canadensis* and *Lactuca Virosa*, both produce a thick latex containing rubber. Another promising plant of the arid region is "Strockle's Rubber Bush," a robust member of the *Compositæ* family.

As to the arid section of the Temperate Zone, it is amply provided with guayule (*Parthenium Argentatum*) pingue, grease-wood and *Candelillia*. It is stated that since the first of these can be successfully grown in Mexico, it should thrive equally well in the southwest of the United States. Pingue (*Actinella Richardsonii*), with less rubber than guayule, has superior advantages in other respects.

Nevada greasewood contains rubber, as shown by Ellis and Warner's patent of 1902. A large amount of this plant is reported to be available.

In North Mexico and the Big Bend country of Texas there is an immense growth of *Candelillia*, producing rubber and wax, the latter being used in making hard rubber.

Some 15 years ago rubber growing was attempted with *Ficus elastica* in Key West, Florida, but proved a failure, the conditions being too dry and the soil shallow.

The same tree has grown to a large size in the deep, fertile and moist soil near Miami. Rubber as good as the Mexican "Amate" rubber has been grown on a small scale at Palm Beach. Florida, with its large available area of soil suitable in character, seems to offer specially good prospects for rubber cultivation.

While the other plants named are of interest from a botanical point of view, the author considers that only two, guayule and pingue, contain enough rubber to insure profitable working. It is for experimental stations to continue the work of developing the others.—*The India Rubber World.*

THE PRESENT & FUTURE OF THE NATIVE HEVEA RUBBER INDUSTRY.

BY JACQUES HUBER, MUSEU GOELDI, PARA.

The following extract is culled from the *India Rubber World* of January 1913:—There is an opinion common among people interested in plantation companies that Brazilian rubber will be entirely supplanted by the product of the Eastern plantations within the next ten years. But it is a case where the wish is father to the thought. There seems to be no necessity for the disappearance or the reduction of the Brazilian crop. On the contrary, there will be increased need for the Amazon crop of rubber—and especially for the hard cure Para. The advent of plantation rubber has helped the industry as a whole, assuring the manufacturer that there will be no shortage in the supply, and tending to the general lowering of prices.

Brazilian producing centres appreciate the competition of the plantation and are preparing themselves to improve their position by lowering the cost of production. On the other hand, the plantations doubtless appreciate that Brazilian rubber will be able to hold its position because of its superior qualities, particularly the superior qualit es of the hard cure smoked Para, whose resistence to exterior influence—light and temperature—is so much greater than that of plantation rubber. As an illustration, the stock held by the Para Syndicate, after being kept two years in more or less overheated stores has improved in quality, and it is probably true that where crude rubber has these resisting qualities the vulcanized product will also have them.

One argument often adduced in the atttempt to prove that the native Hevea rubber will disappear is the difficulty of gathering rubber from the scattered forest trees; but this condition has its advantages also. These forest trees, though scattered, are much older and larger than the plantation trees, so that the worker can collect and coagulate as much as 10 kilograms (22 pounds) of rubber in a day, where the plantation tapper gets only 2 kilograms. Moreover, the fact that the native trees are widely scattered protects them from the spread of fungus and other diseases. Another reason cited to prove the disappearance of *Hevea* rubber is the exhaustion of native rubber districts. This is true in some districts in reference to *Castilloa* but not true of *Hevea*. The shortage of labour has not made it possible to exhaust the *Hevea* trees.

A third proof cited that *Hevea* will disappear is the scarcity of labour. It is true that labour in Brazilian forests is six times as expensive as cooly labour on the Eastern plantations, and that is the principal problem that South Americans have to solve. It is cited as a proof of the impending ruin of the Amazon rubber industry that the output has been practically stationary for

the last few years. This is owing chiefly to the deficient organization of the entire industry and a lack of the proper amount of capital for its development. Unfortunately, the profits of the industry have not in sufficient measure gone back into the improvememt of the general conditions, but during the last few years the Government and leading citizens have awakened to the necessity of instituting reforms and introducing improvements on a very large scale. Some of these reforms briefly are as follows: First, an improvement in the means of communication, making the rivers more navigable and building rail roads on the banks of rivers made unnavigable by rapids; second, better food supply-cheaper in price and more accessible. With this in view the Federal Government has planned cattle breeding on an extensive plan in the upper *Rio Branco* region. And third, sanitation and other measures protective of the labourers' health.

In additon there must be special protection for young *Hevea* trees and interplanting among the old trees of the forest. There are seldom more than 10 trees per hectare (about $2\frac{1}{2}$ acres). This number could very easily be doubled. Tapping methods may also be improved, although it may not be possible to adopt those of the Eastern plantation. First, because the trees are already defaced by the native methods, and second, beacuse it would be difficult to train the natives to adopt a new system. The method of preparing the rubber may likewise also be improved, although no change should be made until its superiority over the present effective smoking process should be fully proved.

Is it possible to operate a plantation successfully on the Amazon? is a question constantly asked. There are a few old plantations in the State of Para, but these as a rule have not been very successful. There are some private plantations but their records are not accessible. The new plantations started under the State protective laws are still too young to serve as a criterion. After the enactment of State laws offering many advantages and encouragements to rubber growers there was a rush to obtain these subsidies, and the registration in the Agricultural Department in two years' time has reached the number of 8,000,000 *Hevea* trees to be planted within the next four years. Of these, about 350,000 had been planted at the end of 1911. Rubber plantations planned and operated on a large scale, by companies with sufficient capital, hold out considerable promise in the Amazon region, though plantations here cannot be operated exactly as in the Middle East, because the conditions—and particularly labour conditions are so different. In a general way, rubber planting on the Amazon must either be carried on by the actual occupants of the lands or by companies abundantly financed, which can operate an efficient scheme of colonization together with the planting; and what is most needed to insure success is efficient management. This has been lacking to a considerable extent in earlier plantation experiments as it has been difficult to secure men who have had just the right experience. The evolution of the plantation on the Amazon will doubtless differ from the plantation development in the Middle East. It will probably be of slower growth, but the plantation on the Amazon will undoubtedly come as a necessary complement of the forest rubber extraction, and the whole industry will be placed on a more scientific, more economical and more stable foundation.

CEARA RUBBER.

The following report on several specimens of Ceara rubber (*Manihot Glaziovii*) from the Sudan, Northern Rhodesia and Portuguese East Africa, will be found in the *Imperial Institute Bulletin*, Vol X., No. 4:—

SUDAN.

A small consignment of Ceara rubber from the Government Farm at Kugulu in the Lado District was forwarded for examination and subsequent sale. It consisted of light brown sheet rubber, which was clean and well prepared. The rubber exhibited good elasticity and tenacity.

The results of the chemical examination are given in the following table:—

		Rubber as received. Per cent.	Composition of dry rubber. Per cent.
Moisture	...	1·7	—
Caoutchouc	...	82·7	84·2
Resin	...	6·4	6·5
Protein	...	7·8	7·9
Ash	...	1·4	1·4

The rubber was sold in London at 4s. 9d. per lb., with fine hard Para at 4s. 8d. per lb., and plantation Para biscuits and sheet at 5s. 3d. to 5s. 6d. per lb.

This Ceara rubber was excellently prepared and arrived in England in very good condition. The price obtained for the consignment must be considered very satisfactory, as small lots never realise the full value of the rubber. There is no doubt that rubber of similar character, if offered in commercial quantities, would sell readily at prices approximating to those of fine plantation Para sheet.

NORTHERN RHODESIA.

A small specimen of Ceara rubber obtained from 3½-year-old trees at Freehills, Fort Jameson, was submitted for examination. It consisted of a single biscuit of light brown rubber, clean and well prepared, but presenting a pitted appearance on one surface. The rubber exhibited good physical properties.

The chemical examination gave the following results :

		Rubber as received. Per cent.	Composition of dry rubber. Per cent.
Moisture	...	4·3	—
Caoutchouc	...	71·7	75·0
Resin	...	6·7	7·0
Protein	...	14·6	15·2
Ash	...	2·7	2·8

The sample was rather small for trustworthy valuation, but consignments of similar character would probably realise from 4s. to 4s. 3d. per lb. in London, with fine hard Para at 5s. 3d. per lb.

The results of the analysis show that this Ceara rubber contained high percentages of protein and ash, and that the amouut of resin was also higher than is desirable. The rubber was, however, of promising quality.

PORTUGUESE EAST AFRICA.

Two specimens of Ceara rubber prepared (1) in biscuits and (2) in scrap sheet by the Lewa method were received for examination.

(1) Ceara biscuit rubber.—Small biscuits of pale brown rubber, clean and well prepared, but slightly mouldy on the surface. The rubber exhibited good elasticity and tenacity.

The analysis gave the following results :—

		Per cent.
Loss on washing	...	2·4
Composition of washed dry rubber : ...		
Caoutchouc	...	85·1
Resin	...	6·4
Protein	..	7·4
Ash	...	1·1

The rubber was valued at about 4s. 6d. per lb. in London with fine hard Para at 4s. 4½d. per lb. and fair average quality plantation Para biscuits at 4s. 10¾d. per lb. to 4s. 11½d. per lb.

The rubber contained rather large amounts of protein and ash, and the percentage of caoutchouc was correspondingly reduced. It was, however, of good quality, and consignments of similar character would be readily saleable.

(2) Cear rubber made by Lewa method and then passed between rollers.—Sheets of pressed scrap rubber, dark brown, mouldy on the surface and containing a little impurity in the form of fragments of bark. The strength of the rubber was satisfactory.

The results of the chemical examination were as follows :—

		Per cent.
Loss on washing	...	7·0
Composition of washed dry rubber : ...		
Caoutchouc	...	85·2
Resin	...	4·6
Protein	...	6·6
Ash	...	3·6

The rubber was valued at about 3s. 6d. per lb. in London, with fine hard Para at 4s. 4½d. per lb.

This specimen contained less resin and protein than the biscuits, but more ash, with the result that the percentage of caoutchouc was practically the same in each case. The amount of ash furnished by this specimen was excessive.

THE TAPPING OF RUBBER TREES.

By R. FYFFE.

Excision alone he (the author) believes detrimental to the tree, as the coolies in their endeavour to get the maximum latex almost inevitably cut too deep, thus injuring the lactiferous tubes close to the cambium. These deep wounds heal slowly, retard the growth of the tree and give access to fungus. He does not consider incision alone practical, but advocates a shallow excision combined with incision made by a fine push pricker. Where the points of the pricker are fine they may penetrate the cambium without injury. He does not advocate broad blunt teeth. He got satisfactory results from a push pricker with gramophone needles filed flat on two sides and fitted 1/5 inch apart into a small block of wood. He followed the half herring-bone system on about one-third of the tree's circumference.—*The India Rubber World.*

COAGULATION WITH AND WITHOUT ACIDS.

The Official Handbook and Catalogue of The Third International Rubber and Allied Trades Exhibition, compiled and edited by Mr. A. Staines Manders has just been issued and we take the following article from it contributed by Mr. L. Bellerio :—

It is well known that Kautchuk occurs in the latitices of rubber yielding trees in the form of microscopical, oily globules surrounded by a film. Separation of these globules from the serum is necessary in order to obtain the Kautchuk. This separation is generally called coagulation, although a more correct technical term would be coalescence or aglutination. Coagulation really means the curdling in a flocculent state, of particles held in suspension in a liquid medium, but in the method generally adopted in the preparation of plantation Hevea, the single particles unite into a compact and consolidated clot. The separation of the rubber is initiated by the coagulation of the albuminoid substances which are present in the latex. In the nature of these substances depends the method of preparation to be adopted, but it may be taken for granted that all the albumin-precipitating agents produce at the same time the separation of rubber.

In the manufacture of Plantation Hevea, which is at present of the greatest interest, the separation is performed by means of acids, mineral or organic, the one generally adopted (in about ninety-five per cent. of the cases), being acetic acid. It was introduced and recommended in 1908 by Parkin, for the preparation of Hevea rubber in Ceylon. The original reason for its adoption must have been the erroneous deduction that acetic acid was the essential product and main coagulating agent in the Amazon curing process. This process is too well known to need further description, it cannot, however, be termed a true process of coagulation, as all the components of the latex remain in the finished product. The dry distillation of the Uruthuri nuts, not only produces acetic acid, but vapours of various acids, empyreumatic products, and the preserving and disinfecting phenol derivatives ; all these, together with the drying heat of the smoke and the resulting contraction in the rubber ball, yield the product of standard type and of practically constant composition which make it so esteemed by manufacturers of rubber goods. Apart from its technical imperfections, the rubber-smoking process as carried out in Brazil, still remains the ideal system of preparation. But acetic acid probably only takes a subordinate action in this curing process, as neither free acid nor acetates, have with any certainty yet been traced in Hard Para. Acid reaction and distinct traces of acetic acid have, however, been detected in Plantation Hevea, whenever this agent has been used for its preparation, and this in spite of careful working and thorough washing. And this advantage has been in many cases detrimental to the general use of Plantation Hevea. Some chemists even went so far as to condemn and some manufacturers to reject its use for the manufacture of cables and insulated wires. (That acid is still present in plantation rubber can often easily be detected where the method is adopted of drying freshly prepared rubber on brass, copper or iron gauze or wires).

In the course of investigations I have now found a new way of preparing rubber. It is a process of proper coagulation without acids at all, the reaction taking place in an alvaline medium throughout. The resulting rubber is of great strength and elasticity and of uniform colour. As it can be worked into any commercial form with the machines already in use, and as in preparation on a large scale the difference in cost of chemicals would probably be in favour of this alvaline process, there appears to be no objection to the general adoption of this method. Rubber so prepared is now undergoing vulcanizing tests in different factories in Europe and America, results of which will later be made public.

THE WORLD'S RUBBER MARKETS.

New York, Liverpool, London, Hamburg, Antwerp, and Havre are at the present time, by their order of importance, the principal world's markets for rubber.

New York, by virtue of the extraordinary development of North American industries, which in a steadily increasing scale, are consuming constantly greater quantities of raw material, receives almost half of the rubber produced in all the world. Nearly 60 per cent. of the rubber negotiated in New York is Brazilian. After this follow Central America and Mexico; but as rubber proceeding from all parts appears in the New York market it is evident that there is no specialty in this business.

Liverpool, perhaps due to the fact of its being the port to which the lines of navigation that run to and from the Amazon are directed, has become the European emporium for Brazilian rubber. In fact, 40 per cent. of the Brazilian production is directed towards that city. Liverpool also receives rubber of various qualities proceeding from the English and other European possessions in equatorial Africa.

The increasing production of the Oriental plantations finds in London one of its principal markets for the precious gum. Although rubber proceeding from different parts appears in the market, it may be affirmed without hesitation, that London is the special centre for cultivated refined rubber (plantation) which is easily explained by the fact that the owners of the extensive plantations in the Malay States are nearly all of them London Companies.

Occidental and Oriental Africa, principally German Colonies send to Hamburg the greater part of the rubber which is negotiated on that market. Brazil enters with about 20 per cent. of the total amount of the business.

Antwerp owes its rubber trade to the creation of the Congo Free State, whose production, now in decline, is practically all directed to this city. It also receives rubber from Brazil, and seeing that Belgian capital is employed in the Oriental plantations its future is promising.

Havre, on the other hand, is of greater importance to Brazil; where 75 per cent. of the transactions are in Brazilian rubber. It also imports the Congo species, as also those of some of the French Colonies in Africa. However, the great bulk of the production of these colonies is directed to Bordeaux.

The methods of sale adopted in these markets, vary very much. From the slow old-fashioned process of sale by private treaty, to sales on time terms, passing through auctions and underwritings, in short all the commonly known modes of negotiating are in use

The most important market, that of New York, adheres to the old-fashioned method of personal contracts for immediate delivery, which certainly serves better the interests of buyers, than those of sellers; the agitation that was created round this question with a view to reform the market, gave no result whatsoever.

Liverpool presents us the polymorphic type. Private sales, and sales on a fixed day for delivery, or sales by auctions, all take place, consulting thereby the preferences of both sellers and buyers, and establishing the free course of the values. The same happens in London, where, however, the Plantation companies have initiated more advanced transactions, such as sales of crops in anticipation.

Hamburg and Antwerp also practise sales by auction and on delivery. However, in this latter the method of underwriting is that most in vogue and which among all the processes is the one that consults most the interest of the seller. This is carried out in the following manner: A broker advertises a certain quantity of rubber for sale, the particulars of which he supplies (name of seller, weight, quality, estimated price, etc.), about twenty days beforehand. On the day appointed, he receives the offers of purchase closed and sealed; these are then opened in a public place and the prices are inscribed on a schedule divided into columns, each one headed with the name of the house offering. Once this operation has finished, the rubber falls to the highest bidder. The seller has, however, the right to withdraw the goods in case the price that results does not satisfy him.

The Antwerp market adopted this system with the view to competing against cognate markets. As the reducing of the expenses on the product, which corresponded to frs. 2'60 per 100 Kilos, the same being frs. 4'93 and frs. 7'30 in Hamburg and Liverpool respectively, did not suffice, it endeavoured to attract the seller by offering the most advantageous prices, and it seems that it has succeeded in its desideratum.

Havre followed its example and it is greatly to be desired that all the rubber markets adopt the same system, not only for the reasons set forth, but also because it is a safe precaution against the manipulations of speculators.

Brazil has always maintained its predominating position in the world's market for rubber, not only as the greatest producer, but also as the producer of the best quality.

PRODUCTION.

In 1827, the first year about which statistical data exist, Brazil exported 31 tons of rubber; in 1837, 289 tons or say an increase of 932 per cent.; in 1847, 624 tons, or 216 per cent. more; in 1857, 1,800 tons, which corresponds to an increase of 290 per cent.; in 1867, 5,826 tons, or 322 per cent. more; 1877, 9,215 tons, thus augmenting by 158 per cent.; in 1887 13,290 tons, or 144 per cent. increase; in 1897, 21,256 tons, representing about 160 per cent. more, and finally in 1907, 36,490 tons, or approximately an increase of 172 per cent.

Within the last decade, that is to say, from 1902 to 1911 (vide statistical statements *in fine*), the exportation rose gradually to 28,631 tons, in 1902, and to 39,026 tons in 1909, the maximum ever reached so far, to descend immediately to 38,546 tons in 1910 and 36,546 tons in 1910 and 36,547 tons in 1911.

Brazil has so far not had any serious competition to fear. It is true that the other producing countries in Central America, South Africa and Asia, send a considerable quantity of rubber on to the market, but this does not affect the Brazilian trade, because, besides being practically all of it of an inferior quality, such extra supply is not sufficient to occasion the harmful effects of an overproduction. It is curious to observe that even within the last decade, the production of those regions which in 1901 was 21,547 tons increased even so far as to surpass the production of Brazil in the year of 1905, reaching then 35,428 tons; but it diminished as rapidly as it had increased and in 1911 we see it reduced to 23,747 tons. This decrease cannot be attributed to the effects of competition, for instance to the plantations of the Orient, whose production commenced to accentuate itself exactly in the year of 1905 and henceforward. As a matter of fact, competition should bring forth a fall in prices, but however, on the contrary, such did not happen, the quotations reaching in the years of 1909 and 1910 such extremes as had never been seen in the rubber market. It will be sufficient to point out that the refined rubber of Para, which is the Standard regulating type of the market and whose average annual price has been 3, 4 and even 5 shillings, went up in those years to 12s. 6d. per pound.

However, a new competitor did appear, which had to be taken into consideration, and which induced the Government of Brazil to adopt some tending to protect its great article of export. The considerable and methodical plantations of the Hevea brasiliensis made in the peninsula of Malacca in Malasia and on the Island of Ceylon, commenced to produce rubber, which it was predicted would within a few years, due to the enormous quantity produced at a low figure, get the mastery of the market.

These plantations, the initial experiments of which date from the year of 1876, with 70,000 seeds sent from the Tapajoz river, an affluent of the Amazon, by Wickham to the Royal Botanical Garden of Kew, have undergone an enormous increment since the year 1896 till to-day; due to the results obtained which indicated beyond possible doubt the advantages of the cultivation of Hevea in view of the constantly increasing price of the product and the new applications which day after day the rubber industry has opened up.

The cultivated-plantation rubber, which appeared on the market with 5 tons in 1901, was represented by 646 tons five years later and at the end of another equal period, by 12,000 tons. It is estimated that if nothing unforeseen happens to the contrary, its production in 1916 will be 70,000 tons, thus reaching the quantity which is at the present consumed each year by the necessities of the industry.

It is believed that by that time the inferior qualities furnished by Africa, Central America and even by Brazil will gradually have disappeared from the market. In order to meet the consumption which, if progression that hitherto has taken place, continues, will then be of 98,603 tons, the production of Brazil and of the Orient together will surely render a quantity much superior to that demand.

The average cost per Kilo of fine Para rubber in the valley of the Amazon is from 3,000 to 3,500; in India of 2,650; however, this difference should disappear under the operation of the Rubber Defence Act, which is inserted further on, and the possible augmentation of the price in the Orient, where manual labour will become dearer later on when all its plantations are in full exploitation, and by the consequent scarcity of labour, against which agriculturists are already commencing to struggle.

The industrial element still continues to give preference to the Brazilian rubber, this being better in quality, nerve and in elasticity—properties which may probably be attributed to the process of curing, which is not employed in the Orient, or possibly to the meteorologic and climate conditions, the geological composition of the soil, etc. It is true that the quotation for planted rubber has been superior to that of wild rubber, but it is advisable not to forget that while the former shrinks only 3 per cent., and has a much better appearance, the latter loses 18 per cent. of its weight. The price difference is thus amply explained and when accounts are made up it is still the fine quality from Para that is the better quoted.—*Official Handbook and Catalogue of the Third International Rubber and Allied Trades Exhibition.*

TOBACCO.

THE SUMATRA SYSTEM.

The following article has been contributed by Amrhyn to the Bulletin Agricole du Congo Belge which is reprinted in the *Bulletin of the Bureau of Agricultural Intelligence and of Plant Diseases*, December, 1912:—

The writer on his return from an expedition for studying agriculture in the Dutch East Indies, gives the following information respecting the cultivation of tobacco at Deli.

Organization of the Plantation.

The large tobacco plantations in Sumatra are usually divided and managed by different sub-directors controlled by one director. A division consists of 3 or 4 sub-divisions, each containing 90 fields. A tobacco field generally covers an area of 1·85 acre, that is to say a "bouw" and a sub-division, including buildings and roads, represents about 173 acres of tobacco. As the rotation is usually an eight year one, the area of a sub-division should be 1,380 acres; a division covers an area of 4,150 to 5,535 acres. This also includes some acres of forest and pasture land.

Climate.

The average temperature at Deli is 28° C., and during the time chosen for the cultivation of tobacco, the thermometer does not fall at night below 22° C. The average annual rainfall is from 100 to 120 inches.

Soil.

The soil of the district of Deli is a marly clay or silt; the marl is rich in humus and the depth of the arable stratum is very variable. A loam soil rich in humus is the best for tobacco growing.

Labour.

It is calculated that 2 or 3 labourers are required per "bouw" (1·85 acre). As a rule, Chinese are employed; these do the work of the nurseries, planting out, interculture, hoeing and gathering the crop. The clearing, first breaking up of the land, building, drainage, etc., is the work of Javans, for the Malays (natives of Sumatra) are unsuitable for skilled work.

In order to promote the immigration of coolies, the planters have established a special bureau, and the Government has appointed a Service for the purpose of enforcing the rules regarding the rights of immigrants. Each cooly is entrusted with the care of a field containing 16,000 tobacco plants, which he plants out, tends and harvests. He receives from 8½ to 11½ florins (14s. to 19s.) for every thousand plants. The work of drying and sorting the tobacco, etc., is paid separately, and by piece. An account is opened in his name, in which he is debited with the amount advanced for his journey, tools, the wages he pays himself to other labourers for work done on the fields of the division entrusted to him, and finally, for an advance 1½ to 3 florins (2s. 6d. to 5s.) and for rice, which he receives every fortnight.

The medical service, which is often at the expense of the estate, is regulated according to the measures prescribed by the Government.

Preparation of the Soil.

About 6 months before the making of the nurseries, the soil of the future plantation has to be prepared. After marking out the roads and the position of the drainage pipes, the forest is cleared and hoed to a depth of 10 or 12 inches. At Deli, the plantations are made on savannahs, which have been broken up by the hoe almost exclusively and ploughed to a depth of 14 or 18 inches. The first ploughing is done 6 or 8 months before planting; three ploughings are made, the last shortly before the seedlings are planted out. These ploughings must never bring up the subsoil.

Nurseries.

Usually the nurseries are prepared during the driest months, *i.e.*, from the middle of January to the middle of March. The seedlings remain 40 to 50 days in the nursery. From the middle of March to the middle of May the rainfall increases in frequence and intensity, and this is the time chosen for planting out. The months of June and July, being drier than the preceding ones, are favourable to growth, ripening and harvest. The vegetative periods last from 60 to 90 days.

The nurseries are placed in the middle of the sub-division, in order to facilitate their superintendence. They are made by preference on a recently cleared portion of virgin forest. The soil is broken up with the hoe to a depth of 16 to 20 inches and the surface is divided into strips of 20 feet by 3 feet., divided by paths, 5 feet., 6 in. broad furnished with a small central drainage ditch. The nurseries run north and south, and artificial shelters are made of rice straw inclined in a west-east direction, which protect the young plants from heavy rain, while at the same time they offer no obstacle to the rays of the morning and evening sun. The nursery should be prepared shortly before sowing, in order that the soil shall be sufficiently friable to ensure the seedlings taking root. Before sowing, the nursery is watered and manured ; the different beds are sown in succession, so as to allow for the time taken in planting out later on. The labourer when sowing mixes tobacco ash with the seed, in order to keep off insects, or else he puts the tobacco seeds in a watering can full of water and thus sows and waters the nursery at the same time. The best time for sowing is the evening, and the weather should be dry; 1 to 1. 5 gr. of seed is used for each bed; too close sowing is avoided. When the seeds have germinated, the seedlings are thinned out so as to leave from 800 to 1,000 plants in each bed. Every evening and morning, the shelters are removed for some hours, so that the young plants may be quickly accustomed to the direct action of the sun's rays. As a rule, they are sprayed on the 15th day with Bordeaux mixture, and from the 20th to the 25th day the shelters are removed for good. Afterwards in order to protect the seedlings from insects on the removal of the shelters, a very transparent white cloth, supported by a frame, is put over the beds; the cloth is removed for some hours after rain and during watering.

Planting out.

The seedlings are planted out after the first rains in the fields of about 20 yards by 275 yards and preferably run north and south. The operation s carried out very rapidly, to ensure the tobacco developing under similar conditions and being homogeneous; as a rule, planting out takes a month and a half, but sometimes it lasts three months. The plants are set 18 inches apart and 3 feet between the rows.

Manures.

These are applied on the day of planting; the chemical fertilizers are mixed previously in different proportions, of which there are the following:—

		I	II	III
Ammoniacal nitrogen	...	3	0	5
Phosphoric acid	...	10	10	10
Potash ...	...	5	10	5

This mixture is given at the rate of 21 oz. per 100 plants and is either applied dry, some being placed in each hole and mixed with the watered earth which is to fill it in, or else it is dissolved in water, 1 ounce of fertilizer being used to the gallon of water; each hole is then given $1\frac{3}{4}$ pints before the plants are put in. The latter method gives the better results.

Care of the Growing Crop.

When all the seedlings are planted out, they are watered every day except in the case of a heavy rainfall; after a week, if they have taken root well, they are earthed up; this process is repeated on the plants reaching a height of 20 inches, and the buds which have formed in the axils of the leaves, together with the broken leaves, or those covered with earth, growing at the base of the plants are removed, and the weeds and vegetable parasites are destroyed; sometimes the plants are earthed up a third time. When the inflorescences form the tops are removed, but the axillary buds which grow after this operation are, as a rule, left.

Seed Plants.

In each sub-division 60 or 80 of the most vigorous and best developed plants are selected; the tops of these are not removed and they furnish the seed for the next year.

Preparation of the Leaves.

The plants reach maturity 60 to 80 days after being planted out and the crop should be gathered at once, when the plants are ripe. In order that no immature leaves may be gathered, the leaves are removed at Deli one by one; four different kinds of leaves are distinguished on tobacco plants:—

4 to 6	sandy leaves	(savonnettes)	
6	from bottom	of stem	
6	,, centre	,,	,,
4 to 6	,, top	,,	,,

The labourer begins by removing all the leaves of the first category and then proceeds to cut off the others in succession. The leaves are gathered very early in the morning and are removed from the field to the shed on a hand-barrow, or in special baskets; they are then placed on mats, where they become soft and pliable. The leaves are made up into wreaths and suspended in the barn; they are then dried and tied into small bundles and subsequently are despatched to a fermentation shed and are afterwards sorted, made up into small bundles and packed. Between the crops, when the harvest is over, the stems are rooted up and the fields made over to the natives for growing rice or planting with teak or *Crotolaria*, or else brushwood is allowed to invade the ground. In Sumatra the cost price of a pound of tobacco sent to the Euroepan markets is estimated at from 0·80 to 1 florin (1s. 4d. to 1s. 8d.). A cooly can clear from 30 to 36 rods of savannah a day, and can dig from 24 to 30 rods to a depth of 18 inches. He can gather and hang up from 32,000 to 40,000 leaves a day.

Pests.

Worms, insects, fungi and bacterial diseases all attack the tobacco plant and have to be kept in check by means of petroleum emulsions, Schweinfurth green, Bordeaux mixture and chloride of lime. There is, however, no remedy for *Phytophthora Nicotianæ*. This fungus causes a rot like the potato disease *(Phytophthora infestans)*. Damp is favourable to its development, and on its first appearance all the infected plants must be uprooted and burnt, the whole bed must be destroyed, and the soil disinfected and worked with implements sterilized by fire.

FLUE CURED TOBACCO.

Bulletin No. 244 of the Bureau of Plant Industry deals with the "Export and Manufacturing of tobaccos by the United States":—

In view of the proposal to give a trial to flue-curing in Ceylon the reference to this method of preparation for the market is of local interest.

Under the flue-curing system it is possible with tobacco produced on certain soil types, to make beautiful and uniform curings of very bright, clear, straw or lemon yellow colour, combined with good life and body and fineness of fibre.

These light coloured tobacco soils are, as a class, naturally infertile, but the judicious use of artificial fertilisers has resulted in increasing the yield as well as improving the quality.

Though the bulk of flue-cured tobacco of bright colour is used for cigarette manufacture, a certain proportion (of darker colour) is used as chewing leaf, plug and twist tobacco and as an ingredient of smoking mixtures.

The trade reports of the principal markets of Great Britain indicate that that country alone annually takes in from 45 to 50 million pounds of American flue-cured tobacco.

The account of this particular kind of tobacco concludes with the following paragraph :—"All things considered, this flue-cured type of tobacco is unsurpassed in universal popularity and general adaptability to a variety of uses, including granulated and cut smoking tobacco, both paper and all-tobacco cigarettes, and plug filler and wrapper; in fact it is adapted to practically all the regular forms in which tobacco is used except standard cigars and snuff. In color and general appearance it is very attractive, while its low nicotine content, mildness, aromatic sweetness, fragrance, and good keeping qualities render it very satisfying to the user."

THE TOBACCO INDUSTRY IN RHODESIA.

PROGRESS OF THE TOBACCO COMPANY OF RHODESIA AND SOUTH AFRICA, LIMITED.

The enormous strides that have been made by those responsible for the tobacco industry in Rhodesia can be best realised by a comparison of the figures at the last annual sale in Salisbury with those of three years ago when the first sale took place. The 1909-10 season's crop offered for sale was 100,000 lbs, and the highest price obtained was 2s. 4½d. per lb. The following season, 1910-11 crop, aggregated nearly 500,000 lbs., while the prices reached 4s. 6d. per lb., the average prices realised being 1s. 2¾d. for Virginian and 2s. 1½d. for Turkish.

This success is largely due to the energy and enterprise of the Tobacco Company of Rhodesia and South Africa, Ltd., an institution which has made it possible for the man with a moderate capital to turn his attention to planting and with the aid of initiative and hard work, to go ahead in the certain hope of prospering. Under agreement with the British South Africa Company, the Tobacco Company took over the control of the warehouses established at Salisbury and Bulawayo. The planters deposit their leaf at the warehouses,

where the Company undertakes to grade and put it into condition for marketing, and sell it by public auction, a very small charge being made to cover the cost of handling. Owing to the large increase in the crops of Virginian leaf grown in Rhodesia, the Tobacco Company found it necessary to build a new warehouse at Salisbury, which was completed last year.

The new warehouse at Salisbury is under the able control of Mr. Rice, who is assisted by a trained staff. The warehouse at Bulawayo, devoted to the exclusive handling of Turkish leaf, is under the supervision of a man experienced in the manipulation of this class of Tobacco.

This year a factory has been erected at Bulawayo, containing the best and most up-to-date machinery for the manufacture of high-grade cigarettes, pipe tobacco and snuff. The factory is worked by a fully experienced staff under the superintendence of a manufacturer who has had a long experience. Our advertising columns announce some of the excellent brands of cigarettes and smoking mixtures which have already been placed upon the market. The Company is also selling Rhodesian cigarettes and pipe tobacco in the United Kingdom, and the sales there are steadily increasing, their good qualities being much appreciated by those who have tried them and like a cool, fragrant and pure smoke.

During the current year the spacious warehouse at Salisbury has been taxed to its utmost capacity in handling the large crop of the 1911-12 season, which, it is estimated, will amount to about a million and a quarter pounds.

The Company has increased the acreage on its established plantations, and is opening up new ones during the coming season for the cultivation of both Turkish and Virginian leaf. The majority of the growers who have already sent their leaf to the warehouse for manipulation and sale have secured substantial advances on their leaf, and some have received from the Company financial assistance towards the opening up and equipping of their plantations.

The policy of the Company is to turn out a high-grade leaf of uniform quality which can successfully compete with the products of countries which have hitherto enjoyed a practical monopoly in supplying the world's markets with leaf for the manufacture of cigarettes and pipe tobaccos. Steps have been taken to bring Rhodesian grown leaf, of both the Turkish and Virginian varieties, to the notice of manufacturers in some of the Overseas Dominions, where it is confidently expected that the high quality of the leaf will enable it to supplant the foreign grown article.

Though the development of the tobacco industry has made such gratifying progress, it must be remembered that it is still only in its infancy, and that greater development both as regards quantity and quality of leaf produced may be looked for. There are considerable areas of land in the extensive sandstone belts of the low veld still practically untouched, but which will be opened up as railways are extended and transport facilities are provided, as the conditions of soil and climate are ideal for the production of a very high-class tobacco, and it is estimated that yields ranging from 900 to 1,500 lbs. of leaf per acre can be secured without the use of fertilisers.

The railways necessary for the development of these areas will doubtless be provided in the near future, and there is every prospect that Rhodesian tobacco culture will rapidly grow into one of the most flourishing and valuable assets to the country, and compare favourably with similar industries in other parts of the world.—*Rhodesia Annual.*

THE CO-OPERATIVE CREDIT MOVEMENT.

PROGRESS IN NATAL.

The more we come to study the rural conditions of Natal the more we are struck with the enterprise, the energy and the intelligence of the farmers of this Province. Take, for instance, the extraordinary progress of the Agricultural Co-operative Union. It stands a splendid example of self-help and sturdy self-reliance of a society which scorns State aid. The name of the secretary, James Erskine Duff, seems to remind us of a Scottish Covenanter resurrected in the twentieth century to stir the dry bones of those colonists who live in this dream-like, lotus land. The Co-operative Union was started three years ago. It was formed by the amalgamation of the Wattle Bark Union and the Mealie Union. The membership is now over 900, and the annual turnover a quarter of a million sterling. To become a member the farmer must take up £5 shares either in one amount or at the rate of 10s. per annum spread over ten years. The idea is a limited liability company. The President of the Union is Sir Thomas Hyslop, and there are three Committees—for Wattles, for Mealies, for Live Stock. Take the matter of commercial manures, such as superphosphate, bonedust, basic slag and mealie fertilizer, all of which are largely used in Natal. The secretary calls for tenders, say, 4,000 tons per annum. Naturally, such a quantity can be bought at a much cheaper rate than a small amount by a single individual. At the commencement of the season superphosphate was sold at £4 per ton to the ordinary farmer, whereas the Union member only paid £3. 7s. 6d per ton. The ordinary man pays 13s. to 14s. per bag of seed oats (150 lb.) ; the Union member can get it for 12s. Formerly the cost of arsenite of soda used for dipping was £3. 5s. per cwt. Through the efforts of this society it can now be purchased from the merchant at £1. 5s. per cwt. The terms of the Union are cash on delivery, but there is also a system called the credit association. This means that three or four members can club together and guarantee their own accounts if approved by the committee, up to twelve months' credit at 8 per cent. interest. This is the buying side of the business. Now as to the selling. The Union has sold this year 60,000 bags of mealies for members at prices ranging from 10s. to 20s. per bag. The members are under no compulsion to buy or sell with the Union. But they realize that the Union saves them much time and trouble and obtains the highest prices. To the up-country farmer the Union is of special value. Take the case of wattle bark. The Union has agents in London and Hamburg, makes contracts and ships direct. The other day a member received £1 per ton above the local market price in Durban. A form is sent out to all the members. They guarantee to supply a stated quantity of bark per month. With this knowledge the Union committee can watch the market and so secure the best price. The individual dealer in Durban does not know what quantity of bark he may have on hand month by month, and, consequently, he cannot offer as favourable terms. The Union also imports pedigree stock, purchases fencing material, publishes a weekly agricultural gazette which is issued free of charge to every member, and now proposes to insure live stock of every description. It is another illustration of the advantage of friendly co-operation in modern farming. The day of isolation, suspicion and farm secrets is dead. The success of a nation is not measured by the fortunes of the few but by the prosperity of every citizen.—*The Agricultural Journal of the Union of South Africa.*

IN THE PUNJAB.

We recently directed attention to the inestimable benefits conferred upon the agriculturists of the Punjab by the extension of the co-operative credit system in that Province. There has just been issued from the Government Press a statement which shows how rapid has been the growth of this beneficent movement throughout India. In the five years from 1906-07 to 1911-12 the number of societies, central, urban and rural, rose from 843 to 8,177 and the total membership from 90,844 to 403,318. The increase in the financial resources of the societies was even more marked. In the first of the years named the capital available, including loans from private persons and from other societies, share capital deposits by members, and State aid aggregated Rs. 23¾ lakhs. By 1910-11 the total had gone up to Rs. 230½ lakhs, while at the end of the past financial year it had still further increased to Rs. 337¾ lakhs.—*Indian Agriculturist.*

CO-OPERATION IN DENMARK.

The November issue of "Denmark Abroad," a monthly review, contains a lengthy article on the Danish Credit Societies by M. P. Blem, President of the Credit Society of Estate Owners in the Danish Island Diocese-Districts. The principle works, as will be known, on the co-operative system.

A Society of land-owners formed by debtors with the object of borrowing money jointly.—It mints its own money according to the daily requirements, in the shape of treasury bonds, on which interest and instalments are to be paid with mortgage security in fixed property—under unlimited responsibility and with a reserve fund as an auxiliary support.

Sixty to seventy years ago there was an upward tendency in the financial condition, but money was scarce. It was almost impossible to procure mortgages, especially on farming properties, and many private persons possessing money dared not lend it out, even against the finest mortgage security. It is gratifying to know that Credit Societies, which as a link between borrower and lender remedied this disagreement. Their treasury bonds became the means of transaction, the means of credit and the substitute for missing money.

CREDIT ASSOCIATION FOR SMALL HOLDERS.

The only credit associations which are supported by the Government are two so called "Small Holder's Credit Associations" founded according to the Bill of May 28th, 1880, the one for Jutland and the other for the Islands. The lowest loan given by The Credit Society of Jutland Country Real Estate Owners being 1200 Kroner, and the one given by the Islands Association 600 Kroner, the small holders were unable to procure smaller loans and much dissatisfaction prevailed. As a result of this dissatisfaction the Bill passed 5 regulations, one of which was that loans can be issued from 100 Kroner to 3,600, Kroner subject to the usual rate of interest and payment.

The credit Societies for Municipalities which was established by Bill passed in 1900 has also its peculiar characteristics. Before this association was founded, small municipalities had great difficulties in obtaining loans on reasonable conditions in spite of safe security.

Lastly, the Industrial Credit Society was founded in 1898 as a union with the object to render loans all over the country to owners of industrial estates and also to estates of similar classification, within a limit of one-half of the appraised value.

Besides the above mentioned societies there is still *Kxeditkassen for Husefere i Kobenhavn* (The Credit Institution for House Owners in Copenhagen), which—as distinct from above-mentioned societies, which are unions of borrowers—is a union of lenders, but which has working principles in the main as all the other societies. This institution which reckons its coming into existence from a foundation charter as far back as the year 1797, and on March 10th, 1912, rest-liabilities to the amount of 97,340,436 Kroner and 29 Ore against treasury bonds amounting to 91,621,750 Kroner and reserve funds to the amount of 5,830,115 Kroner and 29 Ore.

SMALL HOLDINGS AND RENT LANDS.

Many, we may say most, small land-holders, of say 10 acres and under also rent land. It is usually to condemn this practice because these rented lands are so often far away, often in a different parish, that in working them the men folk and often most of the women folk of whole families are away from Monday till Friday, so that the homestead is neglected, and if there are crops on the coffee, cocoa, or fruit trees, these are often made a present to the prædial thief. Then in going to and from these far-off grounds much time, and strength are wasted, and time is capital and strength is capital, and capital is what most people want and which should not be wasted.

The explanation or excuse given for renting such lands is that the soil on the homestead is worn out and they must have fresh land to cultivate provisions. This is not a good argument for men with 5 acres or more of land as we will show. Sometimes, however, the holding is too small to support the family and keep them working. In such cases we consider there is good reason for renting land where it can be got. Again, on a five acre holding we have known every bit of it (but also! this does not often occur) to be under staple crops, and to raise provisions, land had to be rented until more could be got. We have usually found that in such cases the money was not long in being got together and more land got. To be sure the land could not always be got close by or even in the same locality.

There have been interesting debates held by members of branch societies—"Can a five-acre holding support a wife and five of a family" and in every case the result of the debate was that it could.

Intensive Cultivation and Better Yields.

A man with a small acreage especially if worked by his own family, can give more intensive cultivation than can be done on a large holding; more manure is available if there was only an appreciation of the necessity of securing and preserving all waste stuff carefully and using it on the land: each tree or plant can come under the personal observation and attention of the owner. Thus, far better results per acre should be got than are got from large estates, but the reverse is usually the case. Now it is one of the chief aims of the Agricultural Society, through its Journal and the Agricultural Instructors, to explain this to small settlers, and rouse an ambition in them to get better results from their land. There is really no scarcity of land, and will not be until every acre that a man has is productive to its full extent.

Manuring, as is done in most European countries, and certainly to a remarkable extent in China, Japan and to a less degree India, is still hardly practised by the great majority of cultivators here.

The yield from coffee and cocoa trees around the homestead is, on the average, about one-fourth of what the average should be. Forking, drainage,

manuring, pruning, thinning, are all operations that are necessary to be studied and practised. No one should cry out that his trees do not bear, that land is worn out, that he must have land to rent, or buy, until he has first practised the art of the cultivator to the full, on the land that he has. When he has done that, he will be able to buy more land if he wants to. In most cases he will find he has all he can do to keep up the work on his own holding, and that the productions from it are keeping him in comfort and with a surplus to lay by in reserve.

How to Manure Cheaply.

Take a good five-acre holding. There would be one or two acres under coffee or cocoa with breadfruit or orange trees, or both, shading these; close around the house, but not too close that if struck by lightning or by hurricane the trees may fall on the buildings, there would be all kinds of useful fruit trees—pears, ackees, oranges and coconuts, &c., and a paddock for beasts taking up half an acre; an acre in yams, cocoa, sweet potatoes and cassava, a piece in corn and peas; an acre or two acres in bananas. All the beasts would be kept in paddocks and pens, quarter of an acre at a time, so as to manure the land occupied in ground crops the surplus manure being scraped and carried to the staple crops: the coffee, cocoa and bananas. In sugar growing districts, cane would take its part, and always there should be at least a patch of it. Movable pig pens shifted between the rows of these crops and especially placed on all the particularly poor spots or "galls" will soon make all the land rich.

Some places do not allow of being laid off like this, as the land on the holding consists of ridge and valley. Then the best lands are used for bananas, coffee, cocoa, etc., and the ridges for provisions, the beasts being penned on these ridges part at a time to improve the soil. There would at least be a donkey kept, probably also one mule or pony; possibly a cart and two or three mules; in some districts there would always be a cow; in other parts cows are a rarity. There would certainly be a pig or two and a goat or two. If these animals are all brought in and penned at night a great deal of manure can be saved and much land gradually enriched. The fowl manure is, in 99 cases out of 100, wasted. Yet a quart of it mixed with earth, is worth a bushel of cow manure.

It is really more economical for the man with 5 acres and upwards to cultivate by intensive methods the land around his homestead than for him to neglect it and grow crops on lands rented far away from his holding.—*The Journal of the Jamaica Agricultural Society.*

SMOKED RUBBER.

The Wickham process of smoking and curing rubber is still on trial at the Botanic Gardens, Peradeniya, and is proving very satisfactory. Recently his process was tried for curing the rubber from *Funtumia elastica*—the African rubber tree of Uganda fame. The latex of this tree is difficult to coagulate, but treatment in the Wickham B model smoking machine "did the trick," and coagulation took place in one hour and a half: 3lb latex extracted from trees in the Peradeniya Botanic Gardens yielding 5½ oz. of cured rubber.—*The India-Rubber Journal.*

FUNTUMIA RUBBER IN UGANDA.

The following article has been specially contributed by W. M. S. Selwyn to the *India Rubber Journal* of February, 1913 :—

The Rubber tree of Uganda, Funtumia elastica, is principally found in the two large forests called Mabira and Budongo respectively, and in the aggregation of smaller ones known under the collective name of Bugoma Forest. On the N. W. shore of the lake Victoria, near the German Colonial frontier, there is another wooded area containing Funtumia ; being, however, in the sleeping sickness district, it was closed at the time of the writer's visit to Uganda. Funtumia is also said to occur in some of the small woods distributed over the country between the two big lakes, Victoria and Albert. These were also not visited on account of the time required to do so being quite out of proportion to their importance. Then again, judging by the general character of the localities in which these small woods occur, it is more than likely that the bulk of the Funtumia they contain is of the Latifolia variety.

It is generally assumed that the Funtumia has gradually spread from the West Coast of Africa eastward to Uganda, and it is therefore of interest to note that the Mabira Forest is most likely the most eastern part of Africa in which this rubber tree is found, at any rate, in anything approaching appreciable quantities. Furthermore, there is not the slightest doubt that the tree in this forest is much older than in any of the others in Uganda further west. A number of trees having girths of from 60 to 72 inches (measured 3 feet above the ground) were seen there, whereas nothing like such dimensions exist either in the Budongo or the Bugoma Forests.

The Mabira Forest is also much more permeated with Funtumia elastica than is the case in any of the other ones. For the same reason it was difficult to determine the lines on which the propagation of the tree had taken place through this forest. Nevertheless, there were sufficient indications to lead to the belief that the tree had first originated in the eastern part, and from there had gradually spread westward.

Funtumia elastica is essentially a forest tree, and there does not seem to be a single instance, in Uganda at least, of its growing naturally in the open. This is not even the case at Bugoma, in those intervals between the forest which are in the direct line of the rubber belt. The tree is generally found on level land or on the slopes of hills ; it is hardly ever seen on the top of the hills, and never occurs on low lying ground if the latter is at all inclined to be swampy or very damp. In this respect it differs greatly from Latifolia, which is often found in abundance in just such places. In nearly every instance in the Budongo Forest in which there is a deviation from the straight line or any other irregularity in the rubber belt, this is directly traceable to the influence of such conditions.

Funtumia elastica is a straight growing tree, capable of attaining a considerable weight. In the Mabira Forest trees 80 feet high are not uncommon, the average height, when full grown, being however, between 50 and 60 feet. At Budonga trees of the same girth as those at Mabira are uniformly much shorter than the latter, and appear to have but from two-thirds to three-quarters of their height. Similar conditions, but not to the same extent, were noticed at Bugoma.

DISPROPORTIONATE CROWN.

When the tree is young it has a fairly well developed crown. It is, however, characteristic that, after it has reached a certain age, the crown does not at all increase at the same rate as the tree grows, so that it is soon quite out of proportion, even for a forest tree, to the height of the latter.

If for any reason the upper part of the tree is broken off, as a rule a new crown forms on the top of the remaining stump. Then, again at times, for no apparent reason, about one-third or half way down the trunk of a seemingly healthy tree a second crown appears, and as soon as this has reached a certain stage of development, the part of the tree above it, together with the original crown, gradually die down, and finally fall off altogether.

General Habits of the Tree.

Just as the top of the trunk of the tree mostly comes to a sudden stop, and sends out a limited number of comparatively small branches, so also the lower end of the tree often ends suddenly from 6 to 18 inches below the ground, and sends out short roots only slightly inclined from the horizontal. At times this takes place practically at the surface, and then it is possible to remove the earth from underneath the central part of the tree so that the latter stands literally on the slightly inclined roots. When the trunk of the tree extends a short distance downwards into the ground, as stated above, its end presents the appearance of that of the stake or pole put into a hole in the ground, and which has again taken root. From a number of trees which had been uprooted for the purpose, and from others which had been thrown down by the wind, it is evident that the root system is the exact counterpart of the crown, or, in other words, unproportionately small, and not penetrating deep into the ground. The tree therefore depends entirely on the moisture at or near the surface of the ground, and as its own small crown can neither shade its roots nor afford the necessary protection to the surrounding soil, it requires the shade and general protection of other trees. For the same reasons it responds also very quickly to any changes in the weather.

Under favourable conditions, such as, for example, are given by a very dense forest which affords the much needed protection against strong winds, the funtumia elastica is capable of attaining a very old age. As a rule, however, the life of the tree is much shortened, as under ordinary conditions its small root system is far too weak to withstand the strain put on it by a severe storm. The white ant also seems to be a very great enemy of the tree, and attacks it through any opening in the bark whenever for some reason or other the flow of latex is too small to afford the necessary protection. Photo No. 2 shows how in this way frequently trees come to an untimely end. *(Photos not reproduced.)*

Whether both trees as well as crown would have a different development if planted out in the open seems to be as yet an undecided question. Experiments in this direction on a large scale and for practical purposes have so far failed. But, on the other hand, there are about half a dozen trees in the Botanical Garden at Entebbe which, when the writer saw them three and a half years ago, were from five to six years old and showed an entirely different development from those seen in the forests and plantations. It will be of considerable interest to follow the future development of the trees at Entebbe, and to see whether they will finally regain the general characteristics of those in the forest, or whether it is possible by special cultivation to obtain a tree with more favourable conditions.

Not a desirable Plantation Species.

Funtumia elastica has one serious defect which should prevent its use for plantation purposes, and that is its extremely slow growth and the length of time it requires before being capable of giving commercial results. From a number of observations made in the forest it appears that under ordinary conditions the tree is about 20 years old before it attains a girth of from 18 to 20 inches, measured 3 feet from the ground, and another 5 to 10 years are required before this girth is increased to about 25 inches. After its 20th year the annual increase in girth seems to be from ½ to 1 inch, nearer, however, to the former figure than the latter.

According to the natives in the Budongo Forest, the tree, when left undisturbed, loses its leaves annually at a stated time. Tapping operations evidently introduce considerable irregularities, so that in those parts of the forests which are being exploited, trees without leaves will be found at all times of the year side by side with others which show no tendency of leaf-fall.

The bark of the tree is generally quite smooth, and always without any scales. Sometimes it is slightly lumpy, and this is supposed by the natives to be a sign of good latex-yielding qualities. It is very thin, rarely exceeding $\frac{3}{8}$ of an inch in thickness at the base of even very large trees, more generally it is only $\frac{1}{8}$-$\frac{1}{4}$ of an inch thick. Wounds heal up fairly rapidly unless cambium and wood have been too much damaged. In a young tree an ordinary cut in the bark such as produced by moderately fair tapping will be healed in about a year's time, whereas with older trees it would take from two to two and a-half years.

The Funtumia is a slow and poor latex producer, but that which is contained in the bark is yielded up freely, so that any cut made in the latter will drain comparatively large areas. The tree shows no wound response, and can only be tapped at long intervals. In practice it has been found that it needs a rest of at least three months between tapping operations, and frequently even this is not sufficient, especially if the tapping is being carried on to a great height. Even under the best conditions three months seem to be a minimum, so that it is quite possible that better average results would be obtained by giving the tree a longer rest. At Budongo, for example, it had been found that on tapping the trees systematically three times a year, that is at intervals of three months, making the necessary allowance for the dry season, they required a long period of rest every two to three years. (Budongo was not being exploited at the time it was visited by the writer).

Susceptible to Weather Conditions.

In view of the poorly developed root-system the consistency of the latex in the bark is very susceptible to the weather. In the dry season it practically contains no latex at all, and even the short dry spell which sometimes occur during the wet season, at once affect both the quality as well as the quantity of latex. Very wet weather is also unfavourable to tapping operations as on account of the shallowness of the grooves in the thin bark, the latex is inclined to oveflow and spread over the wet surface of the tree, instead of running down the channels into the cup.

The amount of latex produced is very small until the tree has attained quite a respectable girth and corresponding age. As a matter of fact, it does not pay to touch trees under 20 years of age, and even those between 20 and 25 years, as a rule, can only be tapped to advantage once a year. It is really only after the tree has reached the age of 25 years that it begins to have a commercial value, but even then it will be some time before an experienced tapper will take the trouble to tap it, as it practically takes the same amount of time as would be required for tapping much larger trees yielding considerably more latex. Even older trees do not yield very large quantities unless tapping is carried on to quite a considerable height. The result of this has been that one time there was a tendency to go to extremes, and in one place visited the tapping lines were even carried up to the very crown and a short distance along the main branches. Under these conditions the average result obtained from a tree was about one-third of pint per tapping, or one pint per tree per year. (Of course some trees gave considerably larger quantities, and an instance of a yield of five pints for one tree and for one tapping was noticed). It is of course quite natural that when tapping is carried on to such extremes the trees will soon require a long period of rest so that it would be more advantageous not to go beyond about half the height of the tree. There is quite a difference in the consistency of the latex from

the upper part of the tree and that lower down, but this difference is very much smaller than is the case with latex of hevea. With proper care it is quite possible that a full grown tree can be relied upon to give an average of from $\frac{1}{2}$ to $\frac{2}{3}$ of a pint of latex per year, without requiring any lengthy periods of rest every few years. This corresponds to about half pound of rubber.

Resumé and Recommendations.

Funtumia elastica is essentially a forest tree, requiring the protection given by the shade of other trees when it is young, and their general support when grown up. It is not suitable for plantation purposes, nor does it warrant any great capital outlay for the object of making the trees in the forest more accessible to the "white man." At the utmost, the forest might be divided into sections on a large scale, so as to systematise its exploitation to some extent. White supervision in the forests is quite out of the question, as, unless a native is willing to be seen, no "White man" will find him. The best method for exploiting the forests is by natives who are paid by the results brought in. If the latter consists in the latex for treatment in a factory, great care should be exercised before jumping at the conclusion that it has been watered by the tapper. Of two samples of equal consistency, but coming from different parts of the forest, one may have been badly watered, whereas the other is quite unadulterated but comes from a place where heavy rains had fallen recently. A mistake would cause injustice, and the repetition of this might seriously affect the necessary labour supply in a country where no natural but only artificially created inducements for working exist.

THE BYRNE PROCESS.

On Thursday 30th ultimo, a representative of the *India Rubber Journal* attended at a demonstration of the Byrne Process of antisepticising raw rubber. The process consists of volatilising two fluids, of which the composition is not stated, in a specially designed stove. The dense smoke thus produced is led into a chamber containing freshly creped rubber. The rubber is left about three hours in this smoke, by which time the treatment is complete. We understand that the directors propose to issue licenses to work the process on a royalty basis. We shall probably have something further to say later on this subject, when we have fully investigated the new process and its product. Meanwhile it may be noted that the first consignment of rubber prepared on the Byrne method is on its way to London from the Straits.—*The India-Rubber Journal*, February 1st, 1913.

Interesting Facts Concerning the Pine-apple.

The Hawaiian Agricultural Experiment Station has issued recently Bulletin No. 28, dealing with the effect of manganese in the soil on pine-apple plants, and the ripening of the pine-apple fruit. A summary at the end of the publication is reproduced here:—

The root system of pine-apples is very variable and particularly sensitive to adverse soil conditions. When grown in manganiferous soil the roots are less extensive and the ends of the roots are characterized by the development of swollen tips, the appearance of which seems to mark the cessation of the lateral growth of the roots, death and decay immediately following their development. The cells immediately beneath the epidermis of the roots are also somewhat more brown than are normal roots.

The stem of pine-apples serves as a repository for starch and contains large amounts of this substance.

The leaves of pine-apples in common with other members of the Bromeliaceæ contain several rows of palisade cells which contain nothing but cell sap, and the chlorophyll is confined to the spongy parenchyma in the lower three-fifths of the leaf. The fruit contains only faint traces of starch during early growth, and when it reaches maturity starch is absent from it.

The most conspicuous effect of manganese on this plant is seen in the bleaching of the chlorophyll which first begins to fade, the chloroplasts lose their organized structure, and later the colour disappears altogether. Oxalate of calcium is much more abundant in pine-apple plants growing on manganiferous soils. The ash of such plants also contains considerably more lime and less phosphorus pentoxide and magnesia than when grown on normal soils.

During the growth of the fruit relatively small amounts of sugars are stored in it, but within the short period of normal ripening there is a rapid accumulation of sugars in the fruit. Pineapples gathered green do not develop a normal sugar content in subsequent ripening. The sugars of the fruit are derived from the starch previously stored in the stalk.

The study of the pine-apple shows that it is exceedingly sensitive to adverse physical and chemical conditions in the soil. So far as is known at present, there is no really satisfactory programme by which pine-apple can be grown on highly manganiferous soils. It seems best to use such areas for other crops less sensitive to manganese. The best method of handling pine-apples on manganiferous soils consists in applying soluble phosphates and planting old stumps instead of suckers.—*The Agricultural News.*

TEFF.

(*FRAGROSTIS ABYSSINICA*)

By Joseph Burtt-Davy, F.L.S., F.R.G.S.,

Government Astetrostologist and Botanist

Owing to the wonderful success which has attended the introduction of teff into Transvaal, and its value as winter feed for stock, it is desirable that the attention of farmers in the other South African Provinces should be drawn to it.

The chief value of teff as a hay crop lies in its palatability, high nutritive value, narrow albuminoid ratio (for a grass-hay), heavy yield, rapid growth, drought resistance, and ability to smother weeds. Our experience with teff in the Transvaal is that if sown in October, provided we have fairly good rains to establish the braird, we can obtain a cutting of about a ton of hay per acre by the first week of the New Year: at this time we often have ten days to two weeks free from rain, which allows farmers to harvest the crop nicely. Our steady rains usually begin about the middle of January; these induce the teff to start fresh growth which continues till the dry weather begins in March; by this time another hay crop of 1 to $1\frac{1}{2}$ tons per acre can be cut and cured. Light showers usually occur in March, enabling the teff crop to make an aftermath which furnishes good pasturage until it is killed by frost. If weather, etc., do not permit us to sow in October we can sow through January and still secure a good crop.

Historical.

Teff was first introduced into the civilized world as an agricultural crop by the Royal Botanic Gardens, Kew, which imported the seed from Abyssinia in 1886 and distributed it to various botanic gardens and other institutions in

India and the Colonies, including Natal. The primary object of the introduction of this grass was to relieve a famine in India, it being a very quick growing, drought-resistant crop, the seed of which is ground into flour and made into bread by the natives of Abyssinia.

As a result of this distribution the following reports were received:—

British Guiana.—It was reported to make "an excellent fine hay" and to mature in six or eight weeks from the time of sowing. "For this purpose teff is well worth cultivating. It is cleaner and brighter looking than any other grass, and is readily eaten by cattle and horses."

India.—In 1887 seed was given to the Rajah of Jashpore, and was reported upon favourably: "The straw or grass is 4 or 4½ feet in length and smells sweet. The hill people have taken a fancy to the crop." Mr. J. F. Duthie, F. L. S., wrote:—"I have a bad opinion of it as a food-grain, but think better of it as a fodder." Sown in March, the crop was cut in the beginning of May, but sprang up again into a second growth and yielded a cutting of green fodder early in the rains. Sown in July (the rainy season) and cut in the middle of August, the green crop weighed 16,000 lb., or from 2,000 to 3,000 lb., of dried hay per acre. At a hill station (Arnigadh) "the hay made from the teff was of exceptionally good quality and was greedily eaten by the garden bullocks. When it was offered to them they were being fed upon jowar (i.e. kaffircorn) or sorghum stalks, and as is well known, these are remarkably sweet; and cattle, when fed upon them, generally refuse other kinds of dry food until they find that the sorghum is not forthcoming. Our garden cattle, however, seemed to prefer the teff-hay to sorghum, as they would not touch the latter until they had devoured the whole of the teff placed before them! The experience gained here during the last year in the cultivation of teff may therefore be summed up as follows:—When sown in the dry season it will yield a light crop of grain, and when sown in the rains it yields little or no grain, but produces abundance of green fodder, which may be cured into very palatable hay where the latter is preferred. In my opinion teff is destined to become the ryegrass of India, and is well worthy of more extended trial on some of the Government fodder reserves."

Australia.—The reports were equally favourable, the value of this plant for fodder purposes being considered exceptionally high. Its chief merits in this respect are the short time it takes to mature and its suitability to thrive in dry, sandy regions where few other grasses would flourish equally well.

Natal.—Mr. J. Medley Wood, A. L. S., Director of the Natal Botanic Garden, Durban, reported in 1887 as follows: "I received from the Director of the Kew Gardens a small bag of seeds of this plant, which is used in Abyssinia for making bread. The seed is very small, and it appeared to me that it would scarcely find favour in Natal as a cereal, though possibly in some parts of the Colony it might be found useful as a fodder plant. Therefore, after having the seed tested, and finding it quite good, I distributed it in small packets to persons willing to give it a trial, and hope in a future report to be able to record the results." In 1888 he wrote: "This will, as I suspected, have no value as a cereal in Natal, but very favourable reports have been received of it as a quick-growing fodder-grass." Again, in 1889: "It was highly thought of as a quickly growing grass, though as a cereal it proves, as I had suspected, no value in Natal. Whether or no the recipients of the seed have thought it of sufficient value to continue its cultivation, I have no information. De Schonburgk says that it stands drought well, and is a good grazing grass."

Success as a Hay Crop.

In an article on tropical fodder grasses it is stated that "in dry regions suitable for permanent pastures, the Abyssinian teff *(Fragrostis abyssinica)* might be grown during the occasional rains and made into hay. This grass will produce a heavy crop of hay in six weeks from the time of sowing. It is very nourishing, and cattle are very fond of it."

About this time Kew very kindly sent me a little seed to California, where I grew it at the experiment station of the College of Agriculture. I was at once impressed with the wealth of hay produced.

But California is a region of winter rains where lucerne thrives to perfection, and where lucerne is, therefore, the staple forage crop. No one who could grow lucerne cared anything about putting in an annual hay crop like teff, and lucerne being in the ascendant, no farmer had room or time for teff.

Preparation of the Ground.

Teff requires a very fine seed-bed, fully as fine as the best prepared lucerne land, for the seed is extremely small and, if buried beneath large lumps of soil, it cannot germinate. Although teff makes an admirable smother-crop for weeds, if it can get the start of them, it is not successful in this direction if the weeds are allowed to come up first.

Sowing.

The seed being very fine, it is customary to mix it with twenty times its bulk of sand or sandy loam; it may then be sown with a "fiddle" or other broadcasting implement, or drilled in with a grass drill. The seed should be sown practically on the surface; in fact, it is often harrowed in or it may be sown broadcast behind the harrow. It is important that a thorough harrowing should be given at the time of sowing to kill any weed seeds that may be germinated then; if seeds of such weeds as mestbredie *(Amarantus paniculatus* and *A. Thunbergii)* and stinkblad *(Datura)* get a start of the teff seedling they will keep ahead of it, but if the teff gets the start of the weeds it will smother them, giving them no chance to get light and air; a week, or even four and five days, between harrowing and sowing the teff may be enough to give the weeds the start.

A crop can be grown by sowing 2 lb. of seed per acre; some sow 4 lb., but the usual sowing is about 7 lb., and 10 lb. is better if the lands are weedy and it is desired to produce a thick smother-crop.

Time of Sowing.

The teff seedlings being delicate may be burned off in a ten-day drought if they have not become well established. In choosing the time for sowing, therefore, it is well to avoid those months when a drought is almost sure to occur. In Pretoria we prefer the middle to end of October for the first sowing and the early part of January for the second. It is also desirable to arrange the sowing so that the crop will not be ready for cutting during the normal period of heaviest rains; in Pretoria this is from the middle of January till the end of February; as the summer growth takes about two months, it is usually undesirable (with us) to sow between the middle of November and the end of December. In seasons like the present, when the rains are erratic, one sows teff when there is sufficient moisture to bring it up, taking chances on a dry spell, for, after all, the seed is cheap and quickly sown.

Preparation of the Crop.

Teff is primarily a hay-crop. Being fine in stem and leaf it dries quickly, and must not be left long exposed to the sun. It is too fine to make good silage, and as it is so easily turned into hay it would be a waste to ensile it (unless the weather remained too continuously wet to make hay), for good hay is always considered better than good silage. Teff being fine, it bales well into compact heavy bales.

It may be ploughed under as a green manure crop to advantage, for though it is not a leguminous nitrogen gatherer, it will add a lot of humus to a "burned out" soil if ploughed in while green.

All stock like it and do well on it. We have tried it for ostriches with success.

Teff has raised scores of small Transvaal farmers from poverty to comparative comfort, and has been largely instrumental in putting the dairy industry of the Witwatersrand on its feet. The opinion has been expressed by our farmers that "if the Division of Botany of the Department of Agriculture had done nothing else, the introduction and establishment of teff as a farm crop would have more than paid South Africa the whole cost of the Division for the ten years of its existence."—*The Agricultural Journal of the Union of South Africa.*

THE PRESERVATION AND USE OF MAIZE FOR STOCK FEED.

The following notes have been contributed by Mr. Joseph Burtt Davy, F.L.S., Government Agrostologist and Botanist, to the *South African Agricultural Journal* of January, 1913.

Much waste of good silage often takes place through ignorance of the fact that it spoils quickly if left exposed to the air; the advent of fresh oxygen facilitates decomposition. To prevent this waste a certain amount of the exposed surface must be removed regularly each day after the pit has once been opened. With a rectangular pit a better check can be kept on the amount of surface exposed than with a circular pit. In opening the pit it is customary to begin to remove the soil for a width of about 6 feet at one end, and to feed the material from this space until the bottom is reached; this leaves room to work. After this a portion of not less than 2 in. thick is removed from the exposed surface every day, and no more is uncovered than can be treated in this way. Chopped silage is usually filled into bags, and is then easily carted to the place where it is required.

Care should be taken when the feeding with silage is commenced; if fed indiscriminately it may cause scour. The quantity should be small for a few days, and increased gradually. Chopped silage can be conveniently mixed with mealies and bran when the latter are also used. If silage is fed in the open, only put out as much as will be consumed daily, as it is likely to deteriorate if exposed to the atmosphere for a lengthened period.

The character of silage is such that, even though cows seemingly thrive on it even when fed alone, some dry roughage should be supplied with it. As maize silage is rich in carbohydrates and low in protein, the complementary roughage should preferably be a nitrogenous food, such as lucerne hay, cowpea hay, velvet bean hay, or peanut hay; even teff hay, though not as rich in protein as these, may be used with advantage.

Good maize silage always contains a liberal supply of ears, and the amount to be fed depends directly upon the proportion of ears to forage. From 30 to 50 lbs. is the usual daily allowance for a cow.

Kinds of Silage.

Silage may be either "sour" (green) or "sweet" (brown). The difference depends on the degree and kind of fermentation, and this again is regulated by the temperature. If the temperature is allowed to rise above 130° F. sweet silage results; if it reaches 150° F. it becomes "brown;" and if it gets to 160° F. and over it become what is known as "burnt" silage,

which is undesirable. If the temperature does not exceed 120° F. the silage will be green or sour. Sour silage is found to keep better than sweet after the silo or stack s once opened for use. When the stock have been fed on sour silage for a few days and become accustomed to it, they are said to prefer it to "sweet." But "sour" silage is apt to leave an unpleasant odour about the premises. The best silage is probably that which is intermediate between the sour and sweet stages.

Composition of Maize Silage.

Russel has studied the chemical changes taking place during the ensiling of maize, and finds that the main groups of compounds found in maize silage are fatty acids, hydroxy-acids, amino acids, basic diamino acids, purin bases, and other bases, besides the ordinary constituents of the plant cell, the celluloses, protein, &c. The non-nitrogenous acids are not found in maize at the time of cutting, and the nitrogenous acids, though they are found, occur to a smaller extent than in silage.

The characteristic silage changes are the disappearance of sugar, of some less resistant cellulose and of part of the protein, and the formation of the bodies enumerated above.

Three agents appear to be involved in making silage—the living maize cell, the enzymes, and micro-organisms. It is considered that the two former bring about the primary and essential changes, the latter only secondary and non-essential changes.

The formation of acetic and butyric acids appears to be a respiration effect. and comes about when the living cell is deprived of oxygen. Sugar disappears during the process.

The decomposition of the protein and nucleo-protein is effected by enzymes present at the time of cutting the maize, which can go on acting in the silo even after the cell is dead. Characteristic products of protein-hydrolysis were identified in the silage.

These are regarded as the primary and essential changes.

Bacteria are, however, always present, and attack the less resistant celluloses, the products of protein-hydrolysis, and no doubt other substances as well, but not the resistant fibre. Typical products of bacterial activity were found—formic acid, higher fatty acids, humus and amines.

The growth of mould is inhibited except all the surface layer where air gets in. Here the changes are fundamentally different--there is no development of acetic or butyric acid, the mass is alkaline, non-protein material already existing in the maize is converted into protein, and there is also a loss of nitrogen.

Popular Objections to Silage.

One sometimes hears objection raised to the use of silage, on the ground that it makes the milk taste. When such is the case it is because sufficient and suitable care has not been taken with the feeding. Neither the flavour nor the odour of the silage pass through the body of the cow to the milk, but are acquired from bits of silage scattered about during the feeding. On this account the silage should be fed immediately after milking, so that any odour which may have been disseminated through the cowshed may have disappeared before the next milking time, thus preventing the absorption by the milk of any undesirable flavour.

Planting Distance for Silage or Fodder Maize.

The object being to get as heavy a yield as possible from each acre of ground, and as it is not intended to allow the grain to ripen, the plants may stand much closer than is the case where grain is to be harvested. At the Botanical Experiment Station, Groenkloof, we keep the rows the same distance apart as when we plant for grain (*i.e.*, 3 feet 6 inches), but drop the seed every 5 or 6 inches instead of 18 inches. But no definite rule can be laid down, because so much depends on the local conditions of soil and climate and the particular breed grown. The Pennsylvania Michigan Stations find the most satisfactory distance to be rows 40 inches apart and single stalks 3 to 9 inches apart in the row.

In the Standerton District (Transvaal) Messrs Hutchinson & Shaw (Val Station) leave 3 feet between the rows and plant 10 inches apart in the row, and cultivate just as they would for grain, but they are not sure that 2 feet 6 inches by 10 inches would not give a better yield, though "if planted too thick the bottom leaves die," and the leaf is the most valuable part of the fodder. They use Natal yellow horsetooth, a vigorous grower, which could not be grown as thickly as some other sorts; they plant 14 to 15 lb. of seed per acre.

Best stage of Growth for Ensiling.

The degree of maturity and the condition of succulence are the important factors in deciding when the crop is ready for ensiling. It is impossible to provide a hard and fast rule on these points, as so much depends on local and seasonal conditions. Local experience based on careful observation is therefore the best guide.

Generally speaking, maize for silage should be cut rather greener than for fodder, otherwise it does not pack so well in the silo, too much air is left in the mass, and it is apt to mould. Hunt describes the best condition as being reached when many, but not all, the ears have become dented in the grain, a portion of the husks dry and the bottom three or four leaves dry, with the rest still green. Until this stage has been reached it may be considered that the greener the maize the greater the loss in the silo. He summarises as follows the advantages of allowing the crop intended for silage to arrive at the stage of maturity indicated above:—

(1) Greater yield of water-free substance.
(2) Less total weight to handle.
(3) Less loss in silo.
(4) Superior composition.
(5) Greater digestibility.
(6) Greater palatability, resulting in a greater feeding value per acre at less cost.

The following table prepared by Hunt at the Cornell Station shows the influence of maturity upon weight of fresh and dry substance and loss in the silo :—

Date of Cutting.	Green matter per acre.	Dry Matter Per acre	Dry Matter Per cent. Green Food.	Dry Matter in silage; loss per acre.	Condition of Maize.
	lb.	lb.		lb.	
Aug. 10	19,200	2,672	13.1	752	In full tassel.
.. 16	20,800	3,144	15.1	502	Maize in silk.
.. 22	21,840	3,712	17.4	305	Grains fully formed.
28	19,200	3,744	19.5	288	Grains in milk
Sep. 3	16,960	3,824	22.5	195	Grains still in milk.
.. 9	16,300	4,168	25.3	188	Grains past milk.
.. 14	14,720	4,536	30.8	125	Maize glazed.

If put into the silo before the grain has reached the "glazed" or "roasting" stage the silage is less nutritious than it would otherwise be and is apt to be unduly acid. If. on the other hand, it is allowed to get riper than the "glazed" stage it is less likely to pack well, and mouldy spots or masses will be found among the silage. The over-acid condition is due to excessive succulence and the mouldy condition to lack of succulence. A partial remedy for the first trouble is to wilt the maize more or less before putting it into the silo. For the mouldy condition, prevention is the best remedy—the maize should be cut rather younger. If, however, it has already become a little too old before it has been practicable to cut it, the condition may be improved by pouring a little water over the mass while the silo is being filled, or by adding a little succulent material such as green lucerne, velvet beans, cowpeas, or soybeans. The amount of wilting required for immature maize depends on the degree of succulence, and must be learned by experience—the younger the plants the more they must be wilted.

Methods of Ensiling.

The modern silo is sometimes an elaborate and expensive structure which may cost hundreds of pounds, but good silos can be made in a very simple manner and at small cost. Three methods of preparation are in vogue—stacking, burying in a pit, and preserving in an air-tight chamber. The principle is the same in all cases, *i.e.*, development of a limited degree of fermentation, followed by the exclusion of air to prevent desiccation and to arrest decomposition. The means of attaining these ends is to build up a mass of moist vegetation, which then begins to sweat. If this sweating were allowed to continue indefinitely "spontaneous combustion" would ensue and the mass would be spoiled. The most suitable temperature is from 130° F to 140° F. To allow the whole mass to reach this temperature it must not be too deep at any one time ; to prevent increase of temperature above this point fresh material is added, the added weight tending to compress the lower mass, force out the air, exclude a fersh supply of oxygen, and thus checking fermentation. In practice it is not necessary to use a thermometer

to determine the actual temperature. If the surface heat becomes so great that one can only with difficulty bear to keep the hand on it, more fodder should be added, or the pit (if filled) should be sealed up; but if it does not get warm it should be kept open a few days, and a little water may be poured on to it.

Addition of Salt.

Silage is greatly improved by the addition of salt. Professor Wrightson recommends the use of 1½ lb. to every ton of the green material. A moderate addition of salt to the fodder increases the activity of the secretion of the animal body juices and their circulation, and consequently increases the consumption of protein in the body. Salt has a stimulating influence on the appetite of the animal, facilitates the passage of the albuminoids from the digestive canal into the blood, and in general increases the energy of the vital processes. The feeding of salt is therefore especially useful with horses, young animals, and milk cows when fed to their full capacity. Another effect of salt is to increase the excretion of urine.

The Modorn Silo.

The modern silo is usually built of stone, brick, re-enforced concrete, corrugated iron, wood, or whatever material is both efficient and least expensive. It should be air-tight at the bottom and sides, durable and of such a size that it will hold sufficient material for the needs of the stock. The shape should combine the necessary strength with ease and facility for filling and emptying economically and rapidly. "The more compact the silage the better it keeps. The greater its diameter and the more nearly circular the silo the less the resistance of the sides to packing. The deeper the silo the more compact the silage and the less the surface exposure in proportion to the whole mass. A silo should never be less than 24 feet deep; 30 feet is very much better, and 40 feet is desirable where practicable and the capacity desired warrants it." A circular silo is usually about 30 feet high and 15 or 16 feet diameter, with a stone or concrete foundation. Doors for the removal of the silage are placed in a row up the sides at 6 or 8 feet apart. Some silos in South Africa have been constructed of double walls of corrugated iron, well braced and hooped together, and are reported as having been quite successful.

"The surface area of the silo should be such that the silage will be fed rapidly enough to prevent decay. It should never be more than ten square feet per cow; five is better, while seven and a half gives good results. The riper the silage the less weight the silo will hold. The higher the silo and the greater the diameter the more weight the silo will hold. The weight and keeping quality will depend also upon the manner of filling.....The more slowly the silo is filled the more it will hold. A silo of 16 feet in diameter and 30 feet high will hold—when continuously filled with suitably ripened maize—about 33½ lb. of silage per cubic foot, or about 100 tons of silage. A cubic foot of such silage is a standard daily ration for a cow in milk. The capacity of the silo required may be calculated in cubic feet by multiplying the number of animals to be fed by the days of feeding desired." The construction of modern silos was described and illustrated by Mr. A. Morrison Hay in Farmer's Bulletin No. 59 of the Transvaal Department of Agriculture.

But at best the silo is an expensive item, and where other and more imperative outlay is required on the farm its construction may well be left till later. In the climate of South Africa, at least the greater part of which enjoys a dry winter, excellent silage can be made either in a pit or in stack.

Agricultural Education in the United States of America.

We extract the following from an article written by G. J. Bosman, B.S.A., to the *South African Agricultural Journal* of January, 1913:—

Perhaps no other country in the world is doing more for agricultural education to-day than the United States of America. In each of the forty-eight States and Territories constituting the Union is an agricultural college with an average attendance of about 400 students. In connection with each of these State colleges is established at least one experimental station equipped with an efficient staff of agricultural experts. Furthermore, in a great many States they have gone so far as to have a special agricultural teacher in each high school and normal college. Teachers in the rural public schools are required to have a knowledge of the elements of agriculture so that they can devote a few hours each week to the teaching of that. The American people realize the necessity of teaching the farmer his profession. Through the colleges, high schools, and experiment stations only a small percentage of the people is reached, so another institution or force was created with special purpose of taking scientific knowledge of agriculture to the homes of the farmers. This force was called the Extension Department. The Extension Department teaches the farmer agriculture; his wife, household science; and the boys and girls are being interested in the junior work of these two branches.

The following are a few methods used in imparting this knowledge to the people:—

(a) Short winter courses held in local communities lasting from one to two weeks, and covering the studies of field crops, soils, live stock, and home economics.

(b) Special educational trains traversing the State, on which are discussed such subjects as mealie culture, hog raising, dairying, and domestic science.

(c) Farmers' institutes, boys' judging contests, boys' camps, farmers' picnics, &c., are supervised by the Extension Department.

(d) Experimental and demonstration work on county farms is conducted by the department.

(e) Dairy test associations are formed by the department.

(f) Organizations, such as agricultural clubs, farmers' co-operative organizations, &c., are established.

(g) Schools, both secondary and common, county superintendents and teachers' institutes are held.

(h) Junior work with boys and girls is carried on.

(i) Publications, such as bulletins, circulars, leaflets, and score cards, are issued and distributed by the department.

(j) Correspondence covering all sorts of questions pertaining to the farm and home is answered.

SCHOOLS.

The best way of reaching the largest percentage of boys and girls upon farms with information on agriculture and domestic science is through the medium of the country school. The Extension Department is doing a great deal in promoting the idea of having agriculture taught in the country school. The need of teaching agriculture and domestic science in public schools is obvious if we take into consideration that only a fraction of one per cent. of the pupils of schools ever attend college. Already much is done in the United States of America to get agriculture taught in the public rural schools. The development of this line of work is of the greatest importance as it affects the rising generations of the nation.

Junior Work.

In the State of Iowa, United States of America, seven thousand boys and girls are taking special work in mealie-growing, gardening and domestic science. This work is done according to directions sent out by the Extension Department. The competition among these youngsters is strong in the annual contest and exhibits held at short courses. A couple of years ago the highest yield of mealies produced per acre by one of these boys engaged in this kind of work was 118 bushels, or in South African measure 38 bags. This boy has consequently done a noble work by getting four times as much as the average yield of the mealie belt of the States. He has demonstrated to the farmers the possibilities of mealie culture in the States. The boys in the different countries carrying on this work, obtaining the highest yield, were given a free trip to Washington, and had the honour of being the guests of the President for a few days. The girls who had won in the cooking and sewing contests were given the same privileges. In America the question is not how to arouse interest for this work among the youth, but to get help enough to keep up with the demands for this kind of work among the people.

Organization and Co-operation

Probably the greatest need among our farmers to-day is organization. The rural people need debating societies, clubs of various kinds, and organizations that will "boost" for better agriculture and the welfare of the farmer.

Hand in hand with organization goes co-operation, without which not much can be done to promote agricultural interests. The "working together" of the farmer and the business men in towns in the States is noteworthy. The business men are ever ready to assist financially and personally in all kinds of work like the organizing of a short course, giving premiums for contests and exhibits, &c.

The press also lends valuable assistance by using their papers to advertise and consequently make more successful short courses, institute work, and special agricultural trains. They also open their columns generously for disseminating information that help towards the upbuilding and bettering of agriculture throughout the country.

The above brief sketch of the different branches of work carried on by the department gives a general idea of the scope of the work. The prejudice some of the farmers had at first against agricultural experts has died away long ago. The American people have wakened up and are demanding agricultural education. The Extension Department with its staff of energetic bright men is the powerful machine that is revolutionizing the agriculture of to-day. Through the efforts of this organization more agricultural products are produced, better men and women are made, and happier homes are being established.

May the day soon dawn when in the Union of South Africa we will have such a powerful force at work which will revolutionize agriculture in our country, the same as was done in the United States of America!

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[Journal of the Ceylon Agricultural Society.]

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GINGER.

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